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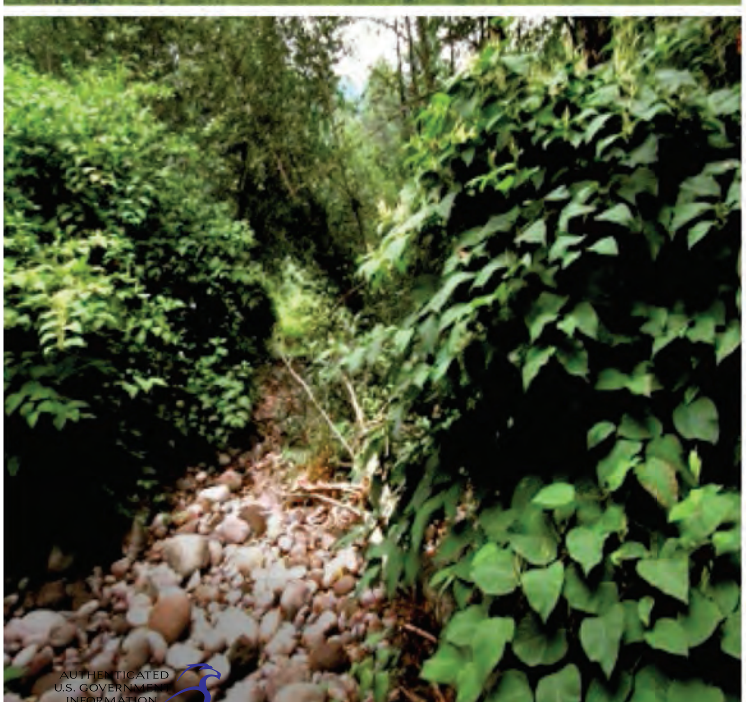
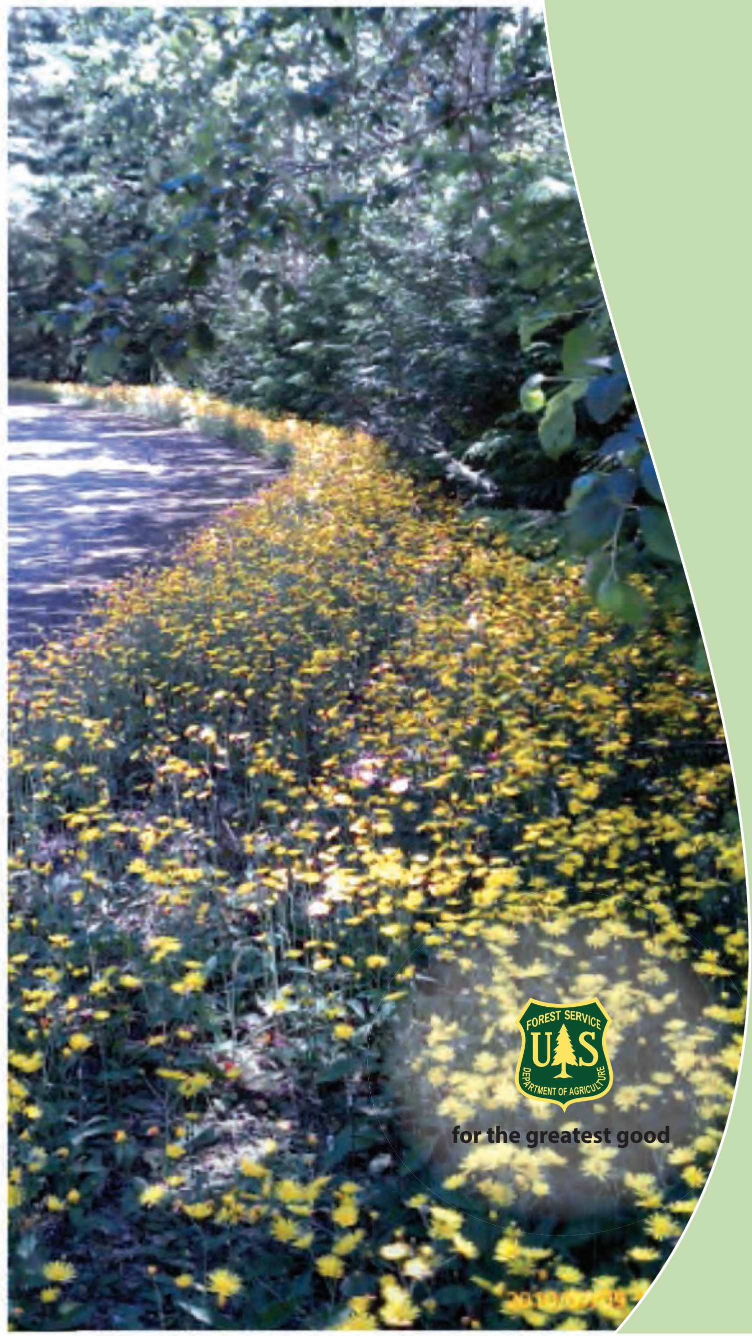
Mt. Baker-Snoqualmie National Forest Invasive Plant Treatment

Final Environmental Impact Statement

Whatcom, Skagit, Snohomish, King, and Pierce Counties, Washington

March 2015





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Mount Baker-Snoqualmie National Forest Invasive Plant Treatment Final Environmental Impact Statement

Whatcom, Skagit, Snohomish, King, and Pierce Counties in Washington

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The FEIS can be viewed and downloaded from the internet at the website address: http://www.fs.fed.us/nepa/nepa_project_exp.php?project=34208. The FEIS and other information for this project is posted under the project name: **Invasive Plant Treatment Project**. The FEIS is also available as an electronic copy on a CD or as a hard copy upon request.

Abstract: This Final Environmental Impact Statement (FEIS) discloses the effects of treating invasive plants in the Mt. Baker-Snoqualmie National Forest (MBS). The Proposed Action would update the current treatment program to more cost-effectively contain, control, and eradicate invasive plants on the MBS. Currently, 936 sites, totaling approximately 4,000 infested acres are mapped within the MBS. In this project, the Forest Service is responding to the underlying need for timely containment, control, or eradication of invasive plants, including those that are currently known and those discovered in the future. The purpose of the project is to achieve the desired condition in a cost-effective manner, while minimizing adverse impacts to people and the environment.

The Proposed Action would increase the number of herbicides and application methods available for use on the ground. A Forest Plan amendment would add aminopyralid to the list of acceptable herbicides. The broadcast method of herbicide application methods would be authorized. Mechanical treatments such as mowing and use of string trimmers would be authorized in combination with other treatment methods. Invasive plants removal in wilderness areas would be authorized. New detections of invasive plants would be treated in a timely manner. All treatments would be done according to Management Requirements and Mitigation Measures (MR/MM), intended to minimize risk and maximize treatment effectiveness.

The FEIS discusses three alternatives: Alternative 2 is the Proposed Action, which is the preferred alternative. Alternative 1 is the No-Action Alternative, which would continue to implement invasive plant treatments approved in the Mount Baker-Snoqualmie Decision Notice for Treatment of Invasive Plants and New Invaders Strategy (MBS 2005 DN). Alternative 3 would approve all elements of the Proposed Action, except that aminopyralid would not be added to the list of available herbicides; the MBS Forest Plan would not be amended.

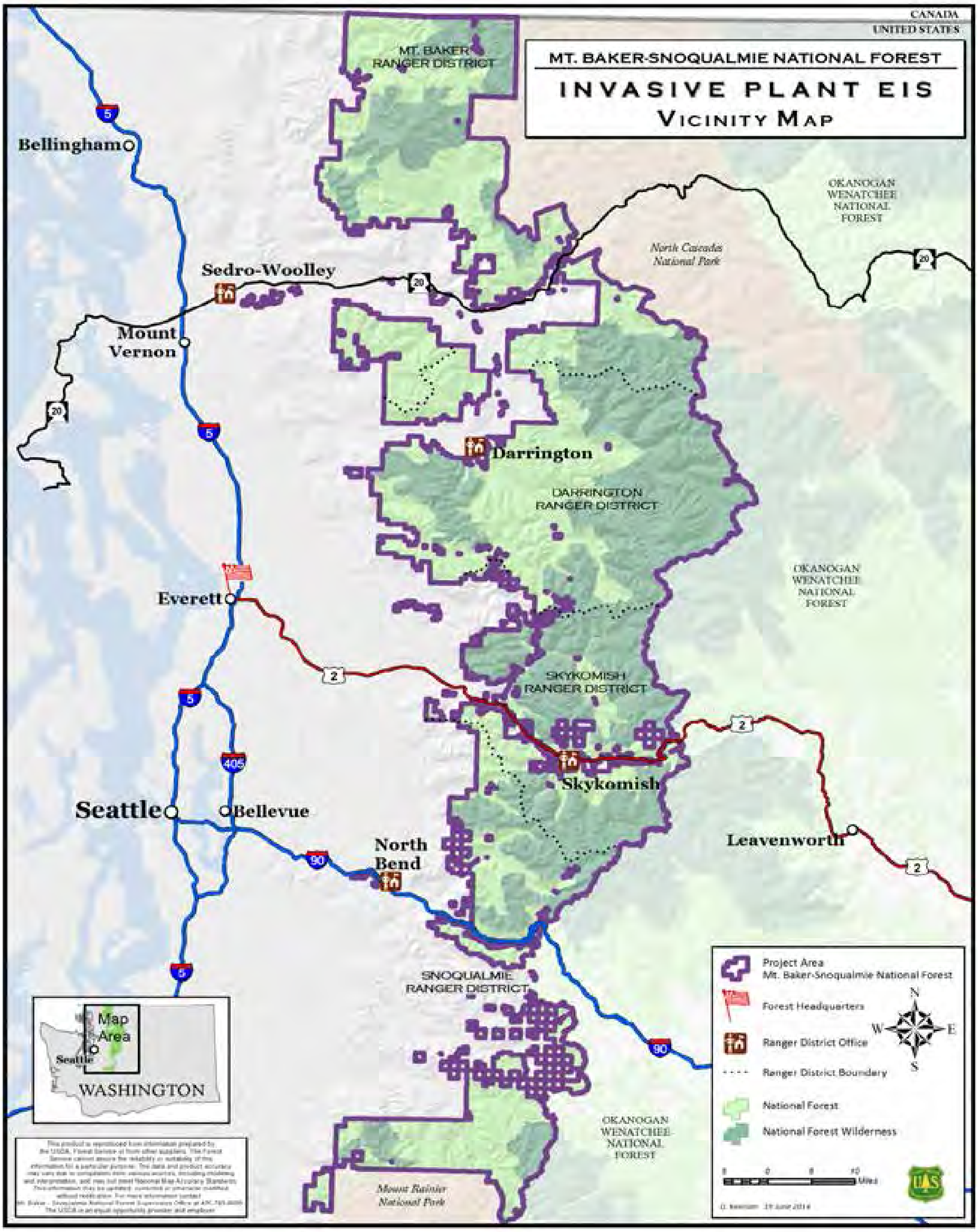

Figure 1. Project area vicinity map

Acronym List

AI	Active Ingredient
ACS	Aquatic Conservation Strategy
APHIS	Animal and Plant Health Inspection Service
BA BCF	Biological Assessment Bioconcentration Factor
BLM	Bureau of Land Management
BMP CFR	Best Management Practices Code of Federal Regulations
EA	Environmental Assessment
EDRR	Early Detection / Rapid Response
DEIS	Draft Environmental Impact Statement
DN	Decision Notice
EIS EPA	Environmental Impact Statement U.S. Environmental Protection Agency
ESA	Endangered Species Act
FEIS	Final Environmental Impact Statement
HUC	Hydrologic Unit Code
GIS	Geographical information System
GLEAMS	Groundwater Loading Effects of Agricultural Management Systems
HCB	Hexachlorobenzene
MR/MM MBS	Management Requirements and Mitigation Measures Mount Baker-Snoqualmie National Forest
IDT	Interdisciplinary Team
IWM	Integrated Weed (Invasive Plant) Management
NEPA	National Environmental Policy Act
NF	National Forest
NFMA	National Forest Management Act
NMFS	National Marine Fisheries Service
NHPA	National Historic Preservation Act
NOA	Notice of Availability
NOI	Notice of Intent
NOAA	National Oceanic and Atmospheric Administration
NPE	Nonylphenol Polyethoxylate
NPDES	National Pollution Discharge Elimination System
NRIS	Natural Resource Information Systems
NWFP	Northwest Forest Plan
PNW	Pacific Northwest
ROD	Record of Decision
RR	Riparian Reserve
SHPO	State Historic Preservation Office
TES	Threatened, Endangered, Sensitive
USDA	U.S. Department of Agriculture
USDI	U.S. Department of Interior
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
WCM	Water Concentration Model

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Summary

S.1 Background

Invasive plants are "non-native plants whose introduction does or is likely to cause economic or environmental harm or harm to human health" (Executive Order 13112). Invasive plants are distinguished from other non-native plants by their ability to spread (invade) into native ecosystems. On the Mt. Baker-Snoqualmie National Forest (MBS), about 40 species of invasive plants have been mapped within 936 sites, totaling approximately 4,000[1] infested acres. The project area includes the entire Mt. Baker-Snoqualmie National Forest, totaling about 1,724,229 acres.

In 2005, the Mount Baker-Snoqualmie Environmental Assessment and Decision Notice for Treatment of Invasive Plants and New Invaders Strategy (MBS 2005 EA/DN) were published. At that time, invasive plant inventories indicated there were 90 individual sites, and most of the sites were smaller than 0.1 acre. The more than ten-fold increase in invasive species sites indicates that the current program has not kept up with the treatment need. This is partly because of increased awareness and mapping, however, this is also because the treatment tools and new invader strategy authorized in the MBS 2005 DN has not resulted in effective invasive plant treatment.

Soon after the MBS 2005 DN was signed, the Regional Forester signed the Pacific Northwest Region Invasive Plant Program, Preventing and Managing Invasive Plants Record of Decision (R6 2005 ROD).[2] The R6 2005 ROD amended the MBS Land and Resource Management Plan (Forest Plan 1990) by adding management direction for invasive plant prevention, treatment and restoration. The R6 2005 ROD authorized additional herbicide ingredients that could increase treatment effectiveness compared to those authorized by the MBS 2005 DN. The Proposed Action is intended to increase the effectiveness of our invasive treatments by using some of these additional herbicides. Since the publication of the R6 2005 ROD, a new herbicide, aminopyralid, has been found to have lower risk to aquatic organisms than previously approved herbicides and higher effectiveness on some broadleaf invasive plant species. The Proposed Action would amend the Forest Plan to authorize the use of aminopyralid. Since 2005, invasive plants have been found in wilderness areas on the MBS. The Proposed Action would allow invasive plant treatment in these areas. In addition, the Proposed Action would allow for use of mechanical equipment (mowers and string trimmers) outside of wilderness areas.

S.2 Purpose and Need

In this project, the Forest Service is responding to the underlying need for timely containment, control, and/or eradication of invasive plants, including those that are currently known and those discovered in the future. Invasive species can adversely affect the diversity and resilience of native plant communities. The Forest Service lacks adequate tools for effective treatment. The purpose of the project is to treat invasive plants in the most cost-effective manner possible, while meeting Forest Plan management direction and minimizing adverse impacts to people and the environment. The more cost-effective the treatments considered, the more likely that the purpose and need will be met.

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[1] Some sites contain more than one target species; when each species is tallied separately, the total acreage is 4,878.
[2] The R6 2005 FEIS and ROD are available on line at http://www.fs.usda.gov/detail/r6/forest-grasslandhealth/invasivespecies/?cid=stelprdb5302157.

This project follows the Standards and Guidelines in the R6 2005 ROD and Mount Baker-Snoqualmie Land and Resource Management Plan (Forest Plan). The project may occur within any Forest Plan designation (management area allocation) on the MBS.

S.3 Proposed Action (Alternative 2)

The Proposed Action (Alternative 2) would allow for use of herbicides in combination with mechanical and other invasive plant treatment methods (manual, biological, cultural) according to specific management requirements and mitigation measures. It would amend the MBS Forest Plan to allow for use of the herbicide aminopyralid. The broadcast method of application would be approved where needed, however, most of the proposed herbicides would not be broadcast near streams and other water bodies or in other sensitive areas. The Proposed Action (Alternative 2) would include an Early Detection, Rapid Response (EDRR) process to ensure that treatment prescriptions and MR/MM are appropriately applied to new sites.

S.4 Key Issues

Two key issues were identified for analysis in this EIS. The issues are treatment cost-effectiveness and herbicide toxicity.

S.5 Alternatives

This EIS considers two alternatives to the Proposed Action. Under Alternative 1, No Action, the current invasive plant treatment approach would continue. This would mean that most treatments on the Forest would be done using one of four herbicides currently approved for use on the MBS (clopyralid, imazapyr glyphosate and metsulfuron methyl), primarily using a backpack sprayer or other selective method. Alternative 3 would include the use of the nine herbicides approved in the R6 2005 ROD, the broadcast treatment method would be approved, and mechanical treatments would also be included. Alternative 3 would not amend the Forest Plan to authorize the use of aminopyralid.

S.6 Alternative Comparison

Table S- 1 compares components of each of the alternatives. Table S- 2 compares the management requirements and mitigation measures for no action and the action alternatives. Table S- 3 compares the approach to new invaders (early detection rapid response) for no action and the action alternatives. Table S- 4 compares the how each alternative responds to the key issues.

Table S- 1. Alternative Components

	No Action (Alternative 1)	**Proposed Action (Alternative 2)**	**No Aminopyralid (Alternative 3)**
Treatment Methods	Manual, biological and chemical (herbicide)	Manual, mechanical, cultural, biological, and chemical (herbicide)	Manual, mechanical, cultural, biological, and chemical (herbicide)
Herbicides Approved	Clopyralid Aquatic glyphosate Aquatic imazapyr Metsulfuron methyl (Skiyou Island only)	Aminopyralid Chlorsulfuron Clopyralid Glyphosate Imazapic Imazapyr Metsulfuron methyl Picloram Sulfometuron methyl Triclopyr	Chlorsulfuron Clopyralid Glyphosate Imazapic Imazapyr Metsulfuron methyl Picloram Sulfometuron methyl Triclopyr
Risk From Invasive Plants	Invasive plants may continue to threaten native plant communities, wildlife habitats and riparian areas.	Most likely to reduce threats from invasive plants	Less likely to reduce threats from invasive plants because aminopyralid would not be approved for use.
Forest Plan Amendment	No	Yes	No
Application Methods	Selective and spot (broadcast at Skiyou Island only)	Broadcast, spot and selective	Broadcast, spot and selective
Potential Broadcast Acres (Known Sites, First Year Treatment)	About 212 at Skiyou Island using glyphosate and metsulfuron methyl	2,470 using aminopyralid, clopyralid, glyphosate and metsulfuron methyl	2,407 using clopyralid, glyphosate and metsulfuron methyl
Treatment Acreage Limitations	None	5,000 per year, 13,500 acres of new detections over the life of the project, 18% of the area within 150 feet of a stream annually	5,000 per year, 13,500 acres of new detections over the life of the project, 18% of the area within 150 feet of a stream annually
EDRR Approach	Annual pre-season list	Develop site prescriptions and address any resources of concern. Use criteria in “decision to use herbicide” to determine preferred method. Integrate MR/MM into implementation prescription based on site conditions. Treat as soon as possible after finding new sites. Treatments would not be limited to those identified in a pre-season report.	Develop site prescriptions and address any resources of concern. Use criteria in “decision to use herbicide” to determine preferred method. Integrate MR/MM into implementation prescription based on site conditions. Treat as soon as possible after finding new sites. Treatments would not be limited to those identified in a pre-season report.

Table S- 2. Comparison of the Management Requirements and Mitigation Measures currently approved under the No Action and Action alternatives

No Action (2005 EA)	Action Alternatives
General	
1. In treating any/all infestations, all applicable management requirements and practices, included in the Forest Plan Prevention Strategy, Best Management Practices (BMPs) for invasive plants will be followed.	Forest-wide prevention measures (BMPs) have been developed and would be followed regardless of alternative selected.
2. In particular, after working in invasive plant sites, all tools, equipment, and gear must be cleaned (power wash or high pressure spraying) before leaving the area, in order to avoid spreading the infestation further (Forest Plan, BMPs).	This measure is included in the action alternatives.
3. All invasive species management must be coordinated with all other site or area resources objectives.	This measure is replaced by specific coordination requirements in the MR/MM for the action alternatives.
4. Biocontrol treatments will use only those control agents that have been approved by the U.S. Department of Agriculture Animal and Health Inspection Service and permitted by the State of Washington.	This measure is Standard 14 from the R6 2005 ROD and would be followed regardless of alternative selected.
5. Any mulch used must be approved as invasive plant free, meeting the Forest Plan, Forest-wide Standards and Guidelines, Prevention Strategy and BMPs.	This measure is Standard 3 from the R6 2005 ROD and would be followed regardless of alternative selected.
General Herbicide Use	
6. No broadcast spraying (aerial or boom) will occur.	The 2008 Skiyou Island DN approved broadcasting for that one area. Both action alternatives would approve additional broadcasting where needed, according to MR/MM and herbicide use buffers.
7. Any preparation, transport, or application of herbicide will be done by trained workers with a current Washington State pesticide applicators license.	All alternatives follow the R6 2005 ROD Standard 15 that requires that people who apply herbicides be licensed or directly supervised by a licensed applicator.
8. Only the aquatic formulation of glyphosate will be used, and at the lowest effective rate as per manufacturer label specifications, which is estimated to be 2 ½ to 5 percent solution of the aquatic formulation of glyphosate diluted in water (3 ounces manufacturer's concentrate per gallon of water). Refer to Mitigation Measure #19, below, for application via stem injection.	This measure is not carried forward into the action alternatives. The lowest effective rate would be used based on the label and invasive plant being treated. Maximum rates for foliar application for the herbicides proposed in Alternative 2 are shown in Table 20 in chapter 3.1. Alternative 3 would use the same rates (but does not include aminopyralid).
9. If needed, the only surfactant that will be used is Agri-Dex®.	This measure is not carried forward into action alternatives. Action alternatives would allow for surfactant use that follows R6 2005 ROD Standard 18. See Appendix E for more information on surfactant. No NPE-based or POEA surfactants would be used. For herbicide applications within 100 feet of streams and other water bodies, surfactants approved by the Dept. of Ecology for use in aquatic environments would be required.
10. Pretreatment briefings will be conducted with all herbicide applicators to emphasize safety requirements, clarify treatment objectives and all mitigation measures, and to clarify identification of both target and non-target species.	This measure is specifically included in the action alternatives.

<table>
<tr><th>No Action (2005 EA)</th><th>Action Alternatives</th></tr>
<tr><td>Herbicide and Surfactant Transport, Mixing, Use</td><td></td></tr>
<tr><td>11. Materials Safety Data Sheets, and Forest Service Information covering glyphosate and Agri-Dex® must be carried in each vehicle at all treatment times, and made available to interested members of the public, on-site.</td><td rowspan="7">These measures have been replaced with the following Herbicide Transportation and Handling Safety/Spill Prevention and Containment measures in the action alternatives.
An Herbicide Transportation and Handling Safety/Spill Response Plan would be the responsibility of the herbicide applicator. 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.
§ 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.
§ Workers will carry only enough herbicide daily to cover the proposed treatment for that day.</td></tr>
<tr><td>12. Glyphosate and Agri-Dex® containers must be secured and prevented from tipping during transport.</td></tr>
<tr><td>13. Workers will carry only enough herbicide daily to cover the proposed treatment for that day.</td></tr>
<tr><td>14. Mix only the amount of solution needed to complete daily treatments.</td></tr>
<tr><td>15. Workers will follow all herbicide label guidelines.</td></tr>
<tr><td>16. Containment mats will be used during mixing, to further avoid the risk of a spill.</td></tr>
<tr><td>17. Do not mix glyphosate or glyphosate with Agri-Dex® within 300 feet of riparian areas, wetlands, or surface water.</td></tr>
<tr><td>18. When glyphosate (with Agri-Dex®) is administered via wand-backpack spray, hand wiped, or painted on cut stems, the applicator will use the lowest effective rate.</td><td>All alternatives would require use of the lowest effective rate of any herbicide used in a given situation. Maximum application rates per acre for the 10 herbicides proposed in Alternative 2 are shown in Table 20.</td></tr>
<tr><td>19. For stem injection: only the lowest effective dose will be used on the MBS. The current recommended effective dose is 100 percent of the manufacturer's concentrate. Trial studies suggest that 2 to 3 milliliters per stem can be effective (The Nature Conservancy 2004, Clallam County 2004). New preliminary research has found that 2.5 milliliters per stem is effective (personal communication, Dr. Timothy Miller, Washington State University Extension Service. Mt. Vernon, WA, May 2005)</td><td>All alternatives would require use of the lowest effective rate of any herbicide used. Stem injection require higher concentrations of herbicide than foliar treatments.</td></tr>
<tr><td>20. Stem injection method would only be used on very small, high-priority infestations with difficult access.</td><td>This measure is not carried forward into the action alternatives. However, stem injection could be used where cost-effective.</td></tr>
</table>

No Action (2005 EA)	Action Alternatives
21. No applications using wand-backpack spray will occur when wind speed exceeds five miles per hour, to lessen drift, or when precipitation is expected within 24 hours.	This measure is part of the action alternatives for broadcast herbicide application methods. Drift is not anticipated for spot applications. No herbicide applications would occur if there is a greater than 80 percent change of precipitation within 24 hours.
22. No hand wiping of leaves with the aquatic formulation of glyphosate with Agri-Dex® will be done when precipitation is expected within 24 hours.	No herbicide applications would occur if there is a greater than 80 percent change of precipitation within 24 hours.
23. Application will occur only outside of timing constraints for wildlife, and when the chance of rain after application is very low.	This measure has been replaced by specific wildlife MR/MM in the action alternatives.
24. Herbicide mixture (aquatic formulation of glyphosate with or without Agri-Dex®) will be colored with a bright, non-toxic vegetable dye before application. This will (a) minimize the possibility of accidentally applying herbicide to non-target species; (b) minimize the amount of herbicide used, by avoiding re-application to plants that have already been treated; and (c) assist anyone who might be gathering forest products or near a treatment area (public or Tribe) in identifying plants and areas that should be temporarily avoided.	In the action alternatives, herbicide mixtures will be colored with a bright, non-toxic vegetable dye before application.
Soils/Water/Fisheries	
25. Soil disturbance (from hand digging, grubbing, pulling, etc.) will be minimized to the extent possible. Restoration of treated areas will follow the restoration treatment proposed for each site.	This measure is not part of the action alternatives; however restoration is part of the action alternatives (see Chapter 2.4.4). Mitigation for soil disturbance near streams is included.
26. As noted above [measure 17], all herbicide spray mixtures (aquatic formulation of glyphosate with or without Agri-Dex®) would not be prepared within 300 feet of riparian areas, wetlands, or surface water.	For the action alternatives, no herbicide mixing would occur within 300 feet of streams.
27. Containment mats will be used during mixing to further avoid the risk of a spill.	For the action alternatives, an impervious material would be placed beneath mixing areas in such a manner as to contain small spills associated with mixing/refilling.
28. Any mulch used must be approved as invasive plant free, meeting the Forest Plan, Forest-wide Standards and Guidelines, Prevention Strategy and BMPs.	This measure is included in the action alternatives as per R6 2005 ROD standard 3.
Wildlife	
29. From January 1 through August 15, restrict all treatment activity in known or suspected bald eagle nest territories.	These measures have been replaced in their entirety in the action alternatives.
30. Baker River Inlet to Baker Lake, Site 106: from November 1 through March 31, restrict all treatment activity near known, occupied eagle roost sites or key eagle foraging areas.	
31. From March 1 through July 15, restrict activities generating noise above ambient levels within 35 yards of suitable spotted owl nesting habitat.	
32. From April 1 through August 5, restrict activities generating noise above ambient levels within 35 yards of suitable marbled murrelet nesting habitat.	
33. For infestation treatments located within or adjacent to suitable nesting habitat for murrelet, leaving of any garbage or trash in the area is prohibited.	

No Action (2005 EA)	Action Alternatives
Vegetation, Plants	
34. MBS Botanists will consistently provide training to contractors, state-wide, to educate them on accurate identification of invasive plants, so that only target species are treated and other desirable species are left unharmed.	These measures have been replaced in their entirety in the action alternatives.
35. If any previously undiscovered rare plants are found within the project area, work will be halted until the USFS botanist is consulted and necessary mitigation measures are enacted.	
Heritage Resources	
36. An information packet will be provided to all personnel involved in the invasive plant treatment prior to project implementation. The packet will contain information on heritage resource identification (such as railroad grades, how to identify prehistoric artifacts, etc.) and instructions for any historic or prehistoric resources that may be found.	These measures have been replaced in their entirety in the action alternatives.
37. If a previously unidentified resource is discovered during project implementation—under any treatment method—or if at any time a resource that may be eligible for the National Historic	
Register of Historic Places is affected, in an un-anticipated way, reasonable steps will be taken to avoid or minimize harm to the resource until the Forest Service can fulfill its consultation requirements in accordance with the Programmatic Agreement for Heritage Resources (1997; see project files).	
Recreation, Public Use	
38. For any site with where recreation use/activity is high and invasive plant infestations are located other than along the peripheral (such as edges of parking lots, along road shoulders, etcetera), any treatment using the aquatic formulation of glyphosate (with or without Agri-Dex®) will occur only during the week, and not on weekends or 3-day holiday weekends. Sites will be signed and flagged, as noted above.	These measures have been replaced in their entirety in the action alternatives.
39. The only two examples among the 91 specific sites proposed for treatment are Gold Creek Pond (polygon # 48) and Buck Creek Camp (polygon # 148). While Buck Creek Camp is not operating for the 2005 season (camp is for sale), any treatment using the aquatic formulation of glyphosate (with or without Agri-Dex®) will be contingent upon scheduling with the Camp management, and/or the care-taker.	
Worker and Public Health and Safety	
40. All workers will comply with Occupational Health and Safety Administration (OSHA) standards, Forest Service Health and Safety Code Handbook, and other guidelines, BMPs, and manufacturers' recommendations to reduce the risk of injury to workers.	This measure is required as a matter of Forest Service policy and would be followed regardless of alternative selected.

Table S- 3. Comparison of New Invader (EDRR) Approach between No Action and Action Alternatives

No Action	Action Alternatives
Based on the previous year's surveys, new invasive plant infestations would be documented [using the forms in Appendix D of the 2005 EA].	Invasive plant sites and treatment plans would be mapped according to Forest Service policy. Data bases such as NRIS and FACTS are used to track invasive plant populations and treatments.
New infestation sites would be prioritized.	No change. Priority would be determined in cooperation with implementation partners.
The current "set" of high-priority sites would be included in each year's prioritization, which could result in a newly-discovered site being ranked as a higher priority for treatment.	New and known sites would be treated according to priority, with some exceptions, for instance, if a medium or lower-priority infestation can be treated as part of another planned project, or as part of a suite of restoration projects within a watershed.
Once a new site is ranked as a high priority, an initial proposed treatment and restoration plan would be selected, based on the type of invasive plant, size of infestation, and location. Tools to make this assessment would include, but not be limited to: the biology of each invasive plant species and their control history [Appendix C of the 2005 MBS EA]; and MBS specific experience with treating invasive species [Appendix B, of the 2005 MBS EA]. The only treatment methods available for selection would be those included in the [2005 MBS] EA, along with all Management Requirements and Mitigation Measures.	The implementation planning process includes developing integrated treatment prescriptions according to MR/MM based on a comprehensive list of site considerations. This project does not include herbicide application directly to water, aerial application of herbicides, use of any pesticides other than herbicides, treatment of aquatic invasive plants (floating and submerged), treatment of native plants, and changes in land uses to slow or prevent the spread of invasive plants. Otherwise, treatments according to all of the design features (MR/MM, herbicide use buffers, treatment caps), would be considered in the scope of the action alternatives.
A new annual newsletter would be produced each spring, listing the new sites. It would be mailed to all interested parties, including agencies (such as U.S. Fish and Wildlife Service (USFWS), and NOAA Fisheries), Tribes, and others. Comments would be solicited.	No annual newsletter required. Notification would occur as per the MR/MM. Consultation with tribes and ESA regulatory agencies would occur as agreed.
For each new, high-priority site: the effects on other resources from treatment/restoration would be estimated. This information would be included in the newsletter.	No additional effects analysis is required for treatments within the scope of the action alternatives. Treatments according to all of the design features (MR/MM, herbicide use buffers, treatment caps), would be considered in the scope of the action alternatives.
If the effects are found to be within the scope of this EA, and USFWS and NOAA Fisheries concur through informal Section 7 (ESA) consultation, sites would be added as addenda.	Report as agreed as a result of Section 7 Consultation.
All treatments would be accomplished as funding is available.	No change.

Table S- 4. How the Alternatives Respond to the Issues

Issue and Indicator	Alternative 1	Alternative 2	Alternative 3
Cost-Effectiveness: Estimated Total Cost in Dollars for Treating Known Sites Known Sites Treatment Plus Restoration	2,719,000	2,535,600	2,630,400
Cost-Effectiveness: Estimated Average Cost Per Treated/Restored Acre in Dollars	557	520	539
Cost-Effectiveness: Estimated Years to Effectively Treat Known Sites Assuming Annual Budget of $200,000 per year	14	12-13	13
Cost-Effectiveness: Estimated Maximum Cost in Dollars, Assuming Average Cost Applied to Known Sites and EDRR Acres	NA	9.5 million	10 million
Cost-Effectiveness: Estimated acres where ability to control or eradicate target species may be compromised due to broadcasting restrictions	1,200	0	274
Herbicide Toxicity/Human Health: Number and character of "plausible exposure scenarios" where "Hazard Quotient" may be greater than 1 for herbicide applicators (workers)	none	Triclopyr HQ = 1.5 for a worker wearing contaminated gloves (15 "first year/first choice" acres)	Triclopyr HQ = 1.5 for a worker wearing contaminated gloves (143 "first year/first choice" acres)
Herbicide Toxicity/Human Health: Number and character of "plausible exposure scenarios" where "Hazard Quotient" may be greater than 1 for the public	none	Triclopyr HQ = 7.8 for consumption of contaminated vegetation (15 "first year/first choice" acres)	Triclopyr HQ = 7.8 for consumption of contaminated vegetation (143 "first year/first choice" acres)
Herbicide Toxicity/Human Health: Character and effectiveness of Management Requirements and Mitigation Measures (MR/MM) intended to minimize or eliminate risk to human health	MR/MM minimize risks; herbicide ingredients pose low risks to human health	MR/MM minimize risks; risk is greater than Alternative 1 due to inclusion of triclopyr, less than Alternative 3 due to inclusion of aminopyralid.	MR/MM minimize risks; risk is greater than Alternative 1 due to inclusion of triclopyr.
Herbicide Toxicity/Botany: Relative risk to botanical species of conservation concern from herbicide use	Very Low, no broadcast near rare plants. Non-selective herbicide use may be needed near water (glyphosate).	Very Low; broadcast treatments are proposed in 7 TAAs where botanical species of conservation concern are located, however MR/MM would minimize risk. Use of aminopyralid is likely to decrease risk compared to non-selective herbicide use.	Low; broadcast treatments are proposed in 7 TAAs where botanical species of conservation concern are located, however MR/MM would minimize risk. Non-selective herbicide use may be needed near water (glyphosate).

Issue and Indicator	Alternative 1	Alternative 2	Alternative 3
Herbicide Toxicity/Wildlife: Relative risk to wildlife from herbicide use	Low risk of herbicide exposure to wildlife. The effects analysis assumes that an animal is directly sprayed, consumes an entire days' diet of contaminated food, or drinks contaminated water for an entire day. These scenarios far overestimate actual exposure levels. The management requirements and mitigation measures would further reduce the potential impacts on wildlife.[3]	Same as Alternative 1	Same as Alternative 1
Herbicide Toxicity/Aquatic Organisms: Relative risk to Aquatic Organisms from herbicide use	Herbicide use poses relatively low risk of impact to aquatic organisms. Aquatic glyphosate poses risk of non-lethal impact to fish, however the MR/MM minimize the potential for herbicide to reach streams.	Same as Alternative 1.	Same as Alternative 1
Herbicide Toxicity/Aquatic Organisms: First year/first choice use of aquatic glyphosate or triclopyr within aquatic influence zones	961 acres of aquatic glyphosate	926 acres of aquatic glyphosate	939 acres of aquatic glyphosate and 12 acres aquatic triclopyr

[3] This section was edited for clarity between the draft and final EIS.

Chapter 1. Purpose and Need

1.1 Background

Invasive plants are "non-native plants whose introduction does or is likely to cause economic or environmental harm or harm to human health" (Executive Order 13112). Invasive plants are distinguished from other non-native plants by their ability to spread (invade) into native ecosystems. Invasive plants include but are not limited to noxious weeds identified on state lists.

On the Mount Baker-Snoqualmie National Forest (MBS or the Forest), about 40 species of invasive plants have been mapped within 936 sites, totaling approximately 4,000[4] infested acres. The project area includes the entire Mount Baker-Snoqualmie National Forest, totaling about 1,724,229 acres.

In 2005, the Mount Baker-Snoqualmie Environmental Assessment and Decision Notice for Treatment of Invasive Plants and New Invaders Strategy (MBS 2005 EA/DN) were published. At that time, 90 invasive plant sites were mapped on the Forest, and most of the sites were smaller than 0.1 acre. The more than ten-fold increase in invasive species is partly due to increased awareness and mapping, however, this is also because the MBS 2005 DN has not resulted in effective treatment of the invasive plants. Since 2005, invasive plants have been located in wilderness areas on the MBS.

Soon after the MBS 2005 DN was signed, the Regional Forester signed the Pacific Northwest Region Invasive Plant Program, Preventing and Managing Invasive Plants Record of Decision (R6 2005 ROD). [5]The R6 2005 ROD added management direction for invasive plants to the MBS Land and Resource Management Plan (Forest Plan 1990), including a list of approved herbicides. Since the publication of the R6 2005 ROD, a new herbicide, aminopyralid, has been found to have lower risk to aquatic organisms than previously approved herbicides and higher effectiveness on many broadleaf invasive plant species found on the Forest.

In 2008, the Skiyou Island Invasive Weeds Decision Notice was signed (MBS 2008 DN). This project allowed for broadcast of glyphosate and metsulfuron methyl (one of the herbicides analyzed in the R6 2005 FEIS), as a part of a vegetation restoration project at Skiyou Island in the Skagit River drainage. Also in 2008, the Forest Supervisor found that use of two additional herbicides analyzed in the R6 2005 FEIS (clopyralid and imazapyr) as a replacement for aquatic glyphosate on some sites would not result in adverse effects beyond the scope of the MBS 2005 DN, based on a supplemental information report (MBS 2008 SIR).

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[4] When acres are counted for each invasive plant target species, the total acreage is 4,878 (about 20 percent of the infested areas contain more than one invasive plant species). Since treatment options and timing of treatment vary by target species, this document frequently cites the amount of treatment acres as 4,878.
[5] The R6 2005 FEIS and ROD are available on line at http://www.fs.usda.gov/detail/r6/forest-grasslandhealth/invasivespecies/?cid=stelprdb5302157.

1.2 Desired Condition

The desired condition relative to invasive plant management in the R6 2005 ROD is:

> In National Forest lands across Region Six, healthy native plant communities remain diverse and resilient, and damaged ecosystems are being restored. High quality habitat is provided for native organisms throughout the region. Invasive plants do not jeopardize the ability of the National Forests to provide goods and services communities expect. The need for invasive plant treatment is reduced due to the effectiveness and habitual nature of preventative actions, and the success of restoration efforts.

To meet this desired condition, invasive plants would be contained, controlled or eradicated,[6] and desirable vegetation would be restored on approximately 4,000 infested acres of National Forest System land. New or spreading invasive plants would be treated as quickly as possible after detection. Invasive plant treatments would be conducted in a manner that minimizes or eliminates human health and environmental risks from treatment activities. Reaching this desired condition could take 5 to 15 years or longer, depending on funding and site-specific response to treatment.

1.3 Purpose and Need

In this project, the Forest Service is responding to the underlying need for timely containment, control, or eradication of invasive plants, including those that are currently known and those discovered in the future. The purpose of the project is to achieve the desired condition in the most cost-effective manner possible, while meeting R6 2005 ROD and other Forest Plan management direction and minimizing adverse impacts to people and the environment. The more cost-effective the treatments considered, the more likely that the purpose and need will be met.

Treatments and planning processes that are currently authorized in the 2005 MBS DN lack sufficient tools and efficiency to achieve timely eradication, containment and control of invasive plants. Following are examples of how the current program has not met treatment needs:

- The herbicides approved in the MBS 2005 DN are not always effective on the invasive plant target species here. For example, glyphosate has been repeatedly applied to hawkweed (in the sunflower family) along the Mountain Loop Highway, yet this target species continues to increase. Additional herbicide options are needed to most effectively treat several invasive species found on the Forest.
- Since the publication of the R6 2005 ROD, a new herbicide, aminopyralid, has been found to have lower risk to aquatic organisms than previously approved herbicides and higher effectiveness on some aggressive broadleaf invasive plant species, such as hawkweeds and knapweeds. A Forest Plan amendment is needed to add this herbicide to the list of approved ingredients for invasive plant treatment.
- The MBS 2005 DN did not authorize broadcast spraying; however, spot treatments are not effective in treating some higher density or larger invasive sites. The broadcast spray method is needed to increase the effectiveness of herbicide applications in some locations.

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[6] A spreadsheet showing the treatment objective for each infested area is available on line at http://www.fs.fed.us/nepa/nepa_project_exp.php?project=34208. "Eradication" means that invasive plants are completely removed from a site. "Control" means that invasive plants have been reduced to low levels on a site. "Containment" means that an invasive plant treatment site is not growing larger.

- New sites have been detected in wilderness areas since 2005. The MBS 2005 DN did not explicitly address treatments of new invaders in wilderness areas. The ability to treat wilderness infestations is needed to minimize the potential for invasive plants to spread within wilderness areas. Currently, six sites in three wilderness areas are in the mapped inventory. About 34 miles of old roads in the Wild Sky Wilderness are unsurveyed but likely contain invasive plants (a recent survey indicates invasive plants are present that were previously not mapped.). Many more trails have not been surveyed but may contain invasive plants. These areas are a high priority to treat to maintain native plant communities within the wilderness. Rapid treatment of wilderness infestations while they are small improves the chances of successfully controlling or eradicating invasive plants in the wilderness, and reduces the potential for impact on wilderness character.
- The MBS 2005 DN did not authorize any mechanical mowing or motorized string trimmers. This method is needed as part of the effective integrated treatment program.
- The strategy for new invaders in the MBS 2005 DN did not provide rapid enough response, for example, common comfrey invaded a log deck and waste rock disposal site in 2008 and tripled in density within 1 year. Increased efficiency in early detection and rapid response to new invaders is needed to reduce the potential for them to become established or spread.

1.4 Management Direction

Several laws, policies and plans provide management direction for invasive plant management. The Federal Invasive Plant Act (1974), as amended (7 U.S.C 2801 et seq.) requires cooperation with state, local, and other federal agencies in the application and enforcement of all laws and regulations relating to management and control of invasive plants (a summary of this act can be viewed at: http://ipl.unm.edu/cwl/fedbook/fedinvasive plant.html) Executive Order 13112 (1999) also directed federal agencies to reduce the spread of invasive plants.

In 2004, R6 issued a Policy for Invasive Plant Prevention that directed National Forests to complete environmental analysis for treating invasive plants (as funding allows), conduct timely treatment of priority infestations, develop invasive plant prevention practices, analyze the potential risks of ground-disturbing activities on the introduction and spread of invasive plants and design and incorporate prevention measures for these activities, and document this analysis in project files (USDA Forest Service 2004c).

The Forest Service Manual 2900 (2011) directs the Forest Service to use an integrated invasive plant management approach to eradicate, control and contain the spread of invasive plants within the National Forest.

Recently, the Forest Service published a National Strategic Framework for Invasive Species Management (FS-1017, August 2013). The framework is intended to increase the effectiveness of Forest Service invasive species management and improve the health and productivity of forests and grasslands. The framework acknowledges that invasive species are among the most important environmental and economic threats facing public lands. The framework notes that estimated economic damage from invasive species has totaled more than $1.4 trillion worldwide, about 5 percent of the world's economy. Early detection and rapid response to new detections, effective control of invasive species, and restoration of treated sites are important objectives of the framework.

1.4.1 Land and Resource Management Plan (Forest Plan) Direction

This Environmental Impact Statement has been prepared in accordance with regulations for implementing the National Environmental Policy Act of 1969 (NEPA), located at 40 CFR 1500-1508. It is tiered to the

Final Environmental Impact Statement (FEIS) for the Mt. Baker-Snoqualmie Land and Resource Management Plan (USDA Forest Service 1990), as amended.

Forest Plan amendments since 1990 include:

- Final Supplemental Environmental Impact Statement on Management of Habitat for Late Successional and Old-growth Forest Related Species Within the Range of the Northern Spotted Owl, as adopted and modified by the April 1994 Record of Decision, which provides additional standards and guidelines (USDA FS, USDI BLM 1994), and commonly known as the ROD, or the Northwest Forest Plan (NWFP).
- Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage Protection Buffer, and Other Mitigation Measure Standards and Guidelines (USDA, USDI 2001).
- Record of Decision to Clarify Provisions Relating to the Aquatic Conservation Strategy Amending Resource Management Plans (USDA FS, USDI BLM 2004)
- Record of Decision for the Pacific Northwest Region Invasive Plant Program: Preventing and Managing Invasive Plants (R6 2005 ROD).

The 1994 ROD includes seven land allocations, which amended the allocations in the 1990 Forest Plan. There is considerable overlap among some allocations, and more than one set of standards and guidelines may apply. The 1994 Forest Plan amendment also includes Forest-wide Standards and Guidelines and an Aquatic Conservation Strategy (ACS) designed to help improve the health of the aquatic ecosystem.

This project may occur within any Forest Plan designation (management area allocation) on the MBS. Table 1 lists the management area allocations that have specific management area direction pertaining to invasive plant management or herbicide use. The R6 2005 ROD (MBS Forest Plan) standards that apply to invasive plant treatment and restoration are in Table 2. The R6 2005 ROD (MBS Forest Plan) includes additional standards to prevent the spread of invasive plants from land uses and activities.

Table 1. Forest Plan Designation and Relevant Standards

Forest Plan Designation	Type of Area	Specific Management Area Direction For Invasive Plants
Northwest Forest Plan (1994)	Riparian Reserves (C-30)	Herbicides, insecticides, and other toxicants, and other chemicals shall be applied [within riparian reserves] only in a manner that avoids impacts that retard or prevent attainment of Aquatic Conservation Strategy objectives.
Northwest Forest Plan (1994)	Late-Successional Reserve	General Guideline – non-silvicultural activities located inside Late-Successional Reserves that are neutral or beneficial to the creation and maintenance of late successional habitat are allowed (C-10). Non-native Species - Evaluate impacts of non-native species (plant and animal) currently existing within reserves, and develop plans and recommendations for eliminating or controlling non-native species that are inconsistent with LSR objectives (C-19).

Forest Plan Designation	Type of Area	Specific Management Area Direction For Invasive Plants
MBS Management Area 12	Mature and Old-growth Wildlife Habitat (pine marten, pileated woodpecker)	Integrated pest management concepts are permitted, except where use of pesticides conflicts with old growth habitat management
MBS Management Area 14	Deer and Elk Winter Range	Integrated pest management concepts are permitted, except where use of pesticides conflicts with objectives of managing winter range and specialized habitats
MBS Management Area 17	Timber Management Emphasis	Use of mechanical, chemical, or manual methods to maintain the stocking level of desirable trees is permitted.
MBS Management Area 15	Mountain Goat Habitat	Utilize integrated pest management techniques, except where use of chemical pesticides conflicts with objectives of managing winter range
MBS Management Area 21A	Green River Municipal Watershed	Integrated pest management concepts are permitted, except where use of pesticides conflicts with water quality objectives.
MBS Management Area 22B	Sultan River Municipal Watershed	Integrated pest management permitted except where use of pesticides conflicts with water quality objectives.

Table 2. R6 2005 ROD Standards and Project Compliance

Standard #	R6 2005 Standard	Project Compliance
11	Prioritize infestations of invasive plants for treatment at the landscape, watershed or larger multiple forest/multiple owner scale.	Infestations with the objective of eradication are generally highest priority; infestations with the objective of control are medium priority; and infestations with the objective of containment are lower priority.
12	Develop a long-term site strategy for restoring/revegetating invasive plant sites prior to treatment.	The long term strategy for restoration depends on the type of site infested, the target species, and location.
13	Native plant materials are the first choice in revegetation for restoration and rehabilitation where timely natural regeneration of the native plant community is not likely to occur. Non-native, non-invasive plant species may be used in any of the following situations: 1) when needed in emergency conditions to protect basic resource values (e.g., soil stability, water quality and to help prevent the establishment of invasive species), 2) as an interim, non-persistent measure designed to aid in the re-establishment of native plants, 3) if native plant materials are not available, or 4) in permanently altered plant communities. Under no circumstances will non-native invasive plant species be used for revegetation.	Revegetation (competitive seeding and planting) would occur as needed to replace invasive plants with native plant communities. Non-native, non-persistent species may be used infrequently as an interim measure to control erosion or prevent target species from returning on treated sites.

Standard #	R6 2005 Standard	Project Compliance
14	Use only USDA Animal and Plant Health Inspection Service (APHIS) and State-approved biological control agents. Agents demonstrated to have direct negative impacts on non-target organisms would not be released.	Agents found to have negative impacts may not be distributed on MBS. The R6 Regional Office updates the list regularly.
15	Application of any herbicides to treat invasive plants will be performed or directly supervised by a State or Federally licensed applicator. All treatment projects that involve the use of herbicides will develop and implement herbicide transportation and handling safety plans.	The elements of herbicide transportation and handling safety plans discussed in the management requirements/mitigation measure section of Chapter 2.
16	Select from herbicide formulations containing 1 or more of the following 10 active ingredients: chlorsulfuron, clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, picloram, sethoxydim, sulfometuron methyl, and triclopyr. Mixtures of herbicide formulations containing 3 or less of these active ingredients may be applied where the sum of all individual Hazard Quotients for the relevant application scenarios is less than 1.0. All herbicide application methods are allowed including wicking, wiping, injection, spot, broadcast and aerial, as permitted by the product label. Chlorsulfuron, metsulfuron methyl, and sulfometuron methyl will not be applied aerially. The use of triclopyr is limited to selective application techniques only (e.g., spot spraying, wiping, basal bark, cut stump, injection). Additional herbicides and herbicide mixtures may be added in the future at either the Forest Plan or project level through appropriate risk analysis and NEPA/ESA procedures.	Management requirements and mitigation measures, including no-broadcast and no-herbicide buffers add layers of caution and minimize or eliminate adverse effects related to use of herbicides. No aerial treatment is proposed in any alternative.
18	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, 2002.	Adjuvant use would be consistent with this standard. Please see Chapter 3.1 and Appendix E for more information on adjuvants.
19	To minimize or eliminate direct or indirect negative effects to non-target plants, terrestrial animals, water quality and aquatic biota (including amphibians) from the application of herbicide, use site-specific soil characteristics, proximity to surface water and local water table depth to determine herbicide formulation, size of buffers needed, if any, and application method and timing. Consider herbicides registered for aquatic use where herbicide is likely to be delivered to surface waters.	Chapter 2 discusses management requirements, mitigation measures, and herbicide use buffers that would apply to the proposed project. Chapter 3 discusses how risks from herbicide use are abated by Management Requirements and Mitigation Measures that restrict herbicide use in near botanical species of conservation concern, certain wildlife habitats, and streams and other water bodies.
20	Design invasive plant treatments to minimize or eliminate adverse effects to species and critical habitats proposed and/or listed under the Endangered Species Act. This may involve surveying for listed or proposed plants prior to implementing actions within unsurveyed habitat if the action has a reasonable potential to adversely affect the plant species. Use site-specific project design (e.g. application rate and method, timing, wind speed and direction, nozzle type and size, buffers, etc.) to mitigate the potential for adverse disturbance and/or contaminant exposure.	Chapter 3 discusses how potential adverse effects to Endangered Species and critical habitats from herbicide use are minimized.

Standard #	R6 2005 Standard	Project Compliance
21	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).	No aerial application is proposed.
22	Prohibit aerial application of herbicides within legally designated municipal watersheds.	No aerial application is proposed. Coordination with water users would occur in accordance with Municipal Watershed Plans (more information in Chapter 3).
23	Prior to implementation of herbicide treatment projects, National Forest staff will ensure timely public notification. Treatment areas will be posted to inform the public and forest workers of herbicide application dates and herbicides used. If requested, individuals may be notified in advance of spray dates.	Chapter 2 lists Management Requirements and Mitigation Measures, including public notification requirements.

1.4.2 Additional Guidance (Laws, Directives and Agreements)

This project follows the National Forest Management Act (NFMA), the National Environmental Policy Act (NEPA), and the Council on Environmental Quality regulations. The project is consistent with all applicable Federal, State and local laws, regulations and agreements, including (but not limited to):

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and the Cooperative Forestry Assistance Act. The Forest Service is authorized by FIFRA and the Cooperative Forestry Assistance Act to use pesticides for multiple-use resource management and maintenance of the quality of the environment as long as the actions comply with the National Environmental Policy Act and the Council on Environmental Quality regulations. Forest Service Manual (FSM 2150) and Forest Service Handbook (FSH 2109) provide direction on safe use of pesticides, including direction on storage and transport, and development of safety plans and emergency spill plans.

Wild and Scenic Rivers Act. Treatment of invasive plants is consistent with preservation of the scenery and natural character of a Wild and Scenic river.

Wilderness Act. Invasive plant treatment within wilderness would preserve wilderness character. Treatments using mechanized equipment and broadcast herbicide spraying is not proposed in wilderness.

Roadless Rule. Invasive plant treatment areas are primarily along roads. The proposed treatments would be consistent with roadless area management direction.

Endangered Species Act. The Forest Service is consulting with the US Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS) to ensure that the proposed invasive plant treatments would not jeopardize the continued existence of federally listed species (or species proposed or considered candidates for listing).

Clean Water Act. A Clean Water Act National Pollution Discharge Elimination System (NPDES) permit is required for herbicide use that may directly enter streams. Treatment along stream banks or for target plants that emerge from or overhang water bodies likely would require a permit.

Clean Water Act compliance includes use of Best Management Practices (BMPs). Specific BMPs are required for chemical use on National Forests (National BMP Technical Guide - USDA Forest Service 2012). The Management Requirements and Mitigation Measures (MR/MM - Table 9) in Chapter 2 integrate the national BMPs. Core objectives for chemical uses on National Forests are provided in the technical guide. These include:

Use the planning process to develop measures to avoid, minimize, or mitigate adverse effects to soil, water quality, and riparian resources from chemical use on NFS lands.

Avoid or minimize the risk of soil and surface water or groundwater contamination by complying with all label instructions and restrictions required for legal use.

Avoid or minimize the risk of chemical delivery to surface water or groundwater when treating areas near water bodies.

The Migratory Bird Treaty Act (MBTA)/Landbird Conservation Plan (Presidential Executive Order 13186, and FS/FWS MOU, Jan. 2001). This act requires federal agencies to assess project actions that may affect avian species covered by these doctrines and their habitats. The MBTA outlines responsibilities of federal land management agencies relative to landbird conservation, and the MOU provides interim direction on implementation of the MBTA. The Forest Service will collaborate with the U.S. Fish and Wildlife Service, as needed, if project actions produce measurable impacts to avian resources.

Grizzly Bear Recovery Memorandum of Understanding(MOU). A MOU between Forest Service and U.S. Fish and Wildlife Service stipulates that there is to be no net loss of core grizzly bear habitat (1997).

Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1801 et seq.), as amended by the Sustainable Fisheries Act of 1996, and its implementing regulations (50 CFR Part 600). The Magnuson-Stevens Fishery Conservation and Management Act as amended by the Sustainable Fisheries Act of 1996, requires Federal action agencies to consult with the Secretary of Commerce (via the NMFS) regarding certain actions. Consultation is required for any action or proposed action authorized, funded, or undertaken by the agency that may adversely affect essential fish habitat (EFH) for species managed in Federal Fishery Management Plans. For this project, the Pacific Coast Salmon Plan manages for Chinook, coho, and pink salmon. EFH regulations, 50 CFR section 600.920(a)(1), enable Federal agencies to use existing consultation and environmental review procedures to satisfy EFH consultation requirements.

The Antiquities Act of 1906. The Antiquities Act (P.L. 59-209, 16 U.S.C. 431-433) authorizes a permit system for investigation of archaeological sites on federal lands and allows the President to establish national monuments on federal lands in order to protect them.

Historic Sites Act of 1935 (16 USC 461). The Historic Sites Act declares national policy to preserve for public use historic sites, buildings, and objects of national significance for the inspiration and benefit of the people of the United States.

The National Historic Preservation Act of 1966, as amended in 1992 (NHPA). The NHPA (P.L. 102-575; 16 U.S.C. 470) extends the policy of the Historic Sites Act to state and local historic sites as well as those of national significance. The Mt. Baker-Snoqualmie National Forest (MBSNF) fulfills its responsibilities under the NHPA through a programmatic agreement (USDA Forest Service 1997) regarding cultural resources management on National Forests in the state of Washington, developed in consultation with the Advisory Council on Historic Preservation (ACHP) and the State Historic Preservation Office (SHPO), pursuant to Section 800.13 of the regulations (36 CFR 800 [1986]).

Native American Policies. The Forest Service's Native American polices are described in Forest Service Manual 1563 and Forest Service Publication FS-446 and FS-600. These policies include maintaining a governmental relationship with federally-recognized tribal governments, implementing programs and activities in a way that honors Indian treaty rights and fulfills legally-mandated trust responsibilities to the extent that they apply to National Forest system lands.

Watershed Analysis. Watershed analysis documents prepared since 1995 were reviewed. A summary of findings from watershed analysis reports that are relevant to invasive plant management is in the Project Record. The design of this project is consistent with the recommendations in the watershed analysis reports.

Late-Successional Reserves. Invasive plant populations threaten native plant communities, particularly along roads and other disturbed areas within Late-Successional Reserves. Removal of invasive plants are revegetation with native plants would help meet Late Successional Reserve objectives. See Wildlife Chapter 3.5 for information about how invasive plants affect wildlife species associated with older forests.

Additional laws, direction, and broader-scale analyses are discussed in the Specialist Reports in the Project Record, which are incorporated by reference in this Environmental Impact Statement. Prevention of the spread of invasive plants from land uses is addressed in the R6 2005 ROD, the MBS 2005 DN, the MBS Forest Plan and Forest Service policies.

1.5 Proposed Action

The Proposed Action would update the current treatment program to more cost-effectively contain, control, and eradicate invasive plants on the Forest. The Proposed Action has six components: (1) use of any of 10 herbicides and approved additives, (2) a Forest Plan amendment to add aminopyralid to the list of available herbicides on the Forest, (3) broadcast herbicide application methods would be used (generally on contiguous infestations that have more than 70 percent coverage with invasive plants), (4) invasive plants would be treated in wilderness areas using all treatment methods except mechanical and broadcast herbicide, (5) the new invader strategy would be modified, and 6) mechanical treatments would be approved for use outside of wilderness areas. More information about the Proposed Action is in Chapter 2.

This project does not include (and additional NEPA would be required for):

- Herbicide application directly to water
- Aerial application of herbicides
- Use of any pesticides other than herbicides
- Treatment of aquatic invasive plants (floating and submerged)
- Treatment of native plants
- Use of mechanical equipment or broadcast spraying in wilderness
- Changes in land uses to slow or prevent the introduction or spread of invasive plants

1.6 Decision Framework

Based on the environmental analysis, the Forest Supervisor will decide:

- Whether to continue to implement the current invasive plant treatment program or authorize changes, including treatment of invasive plants in wilderness areas and use of additional herbicide ingredients.
- Whether or not to amend the MBS Forest Plan to include the use of aminopyralid
- What management requirements, mitigation measures, and monitoring should be applied to invasive plant treatments.

1.7 Tribal Consultation and Public Involvement

Government to Government consultation letters regarding the project were sent to the following local Tribes on 2/24/2012: Lummi Nation, Muckleshoot Indian Tribe, Nisqually Indian Tribe, Nooksack Indian Tribe, Puyallup Tribe, Samish Tribe, Sauk-Suiattle Tribe, Snoqualmie Tribe, Stillaguamish Tribe, Suquamish Tribe, Swinomish Indian Tribal Community, the Upper Skagit Tribe, the Tulalip Tribes and the Yakama Tribe. Follow up calls were made to the tribes to seek comments.

The Snoqualmie Tribe responded (4/16/2012) with a concern that herbicide treatment might occur near traditional harvest areas. No other replies were received from American Indian Tribal governments regarding this project.

Public scoping on this Proposed Action was initiated during fall 2010. In spring 2012, additional scoping was conducted to include additional invasive plant populations and wilderness sites. At this point in the analysis, the Forest Supervisor decided that an Environmental Impact Statement (EIS) would be appropriate to document potential effects of the proposed treatment so a Notice of Intent to prepare an EIS was published in the Federal Register on February 28, 2012. [7]

During the 2010 scoping period, comments were received from 1 agency, 2 organizations and 3 other people. During the 2012 scoping period, comments were received from 4 agencies, 1 organization, 1 American Indian Tribal member (see above), and 10 other people. Scoping outreach and responses are in the Project Record.

1.8 Issues

The Forest Supervisor reviewed public comments received during scoping and the preliminary environmental effects identified by the ID Team assigned to the project. One purpose of the review was to determine if there were any key issues to be addressed, based on criteria for issues in the Council on Environmental Quality (CEQ) regulations at 40 CFR 1501.7. Non-key issues are defined as those:

- Outside the scope of the proposed action
- Already decided by law, regulation, Forest Plan, or other higher level decisions
- Irrelevant to the decision to be made
- Conjectural and not supported by scientific or factual evidence

Issues may be “key” due to the extent of their geographic distribution, the duration of their effects, or the intensity of public interest or resource conflict. Two key issues were identified:

- Treatment effectiveness
- Herbicide toxicity

The key issues were used to (1) improve the project design to better minimize adverse impacts and improve treatment effectiveness; (2) develop alternatives to the proposed action and (3) focus the EIS analysis in Chapter 3.

Chapter 3 also includes analysis to address the following topics:

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[7] Scoping in 2012 included 195 acres in the Yakima River watershed that were removed from analysis in the MBS Invasive Plant Treatment EIS, but will be addressed by planning conducted on the Okanogan-Wenatchee National Forest. The scoping proposal in 2012 also contained a 113.1-acre site (Treatment Analysis Area 54) that was later found to not contain invasive plants, so was dropped from the analysis.

- Findings and determinations for the Endangered Species Act
- Compliance with Clean Water Act, Clean Water Act Permits
- Compliance with management direction, especially MBS Forest Plan Standards and Guidelines
- Impacts on soil and water resources
- Impacts on scenery and recreation
- Cultural and archeological impacts

1.8.1 Key Issue #1: Treatment Cost-Effectiveness

This key issue encompasses comments received relating to the cost-effectiveness of the treatment. Comments included questions about the cost of the project and its ability to effectively treat invasive plants, the effectiveness of hand pulling and other non-chemical methods, the need to use broadcast treatments, the need for flexibility in the "new invader" strategy (also referred to as Early Detection and Rapid Response - EDRR), the need for native plant revegetation on treated sites, and the need for an adaptive management strategy to allow for effective repeated treatments over time. The following indicators are used to compare alternatives in this EIS[8]:

- Estimated Total Cost for Treating Known Sites in 5 years
- Estimated Average Cost Per Acre
- Estimated Maximum Cost in Dollars, Assuming Average Cost Treatment Plus Restoration Applied to Known Sites and EDRR Acres
- Estimated Years to Effectively Treat Known Sites Assuming Annual Budget of $200,000 per year
- Acres Where Ability to Control or Eradicate Target Plants May be Compromised

1.8.2 Key Issue #2: Herbicide Toxicity

Comments about the effects of herbicide on human health, botany, wildlife and fish herbicide use were lumped into one key issue: herbicide toxicity. The following indicators are used to compare alternatives in this EIS:

- **Human Health:** Number and character of "plausible exposure scenarios" where "Hazard Quotient" may be greater than 1 for herbicide applicators (workers)
- **Human Health:** Number and character of "plausible exposure scenarios" where "Hazard Quotient" may be greater than 1 for the public
- **Human Health:** Character and effectiveness of Management Requirements and Mitigation Measures (MR/MM) intended to minimize or eliminate risk to human health
- **Botany:** Relative risk to botanical species of conservation concern from herbicide use
- **Wildlife:** Relative risk to wildlife/habitat from herbicide use (may also find an indicator similar to the one used for fish)
- **Fish:** Relative risk to fish/habitat from herbicide use

[8] Indicators have been edited for clarity.

- **Fish**: First year/first choice use of aquatic glyphosate or triclopyr within aquatic influence zones (two herbicides that may be used near water and are associated with hazard quotients greater than 1 for fish).

The following concerns expressed in the scoping responses are not considered key issues because they are addressed by laws, policies and the R6 2005 ROD/MBS Forest Plan:

- How invasive plant prevention measures are applied to land uses
- Monitoring Protocols
- Findings/uncertainty/credibility of herbicide risk assessment and registration process
- Philosophical objections to or new requirements for herbicide use on the MBS
- Labor source (volunteer, other) and job creation
- Effects from non-herbicide treatments
- Objections to treating invasive plants.

Chapter 2. Alternatives Including the Proposed Action

2.1 Introduction

Chapter 2 describes and compares the alternatives considered in detail for implementation of the Mount Baker-Snoqualmie National Forest Invasive Plant Treatment project. This chapter includes a description of actions common to all alternatives, and actions for each alternative considered. It also compares the alternatives, defining the differences between each alternative and providing a clear basis for choice among options to be considered by the decision maker. Chapter 2 describes the existing invasive plant treatment approach and alternative ways to increase treatment effectiveness, while minimizing adverse effects. All of the alternatives, including no action, would treat invasive plants using manual, chemical, and biological methods. Both action alternatives would increase the number of herbicide options and would authorize mechanical treatments, however Alternative 3 would not include use of aminopyralid.

2.2 Invasive Plant Treatment Methods Common to All Alternatives

Manual, cultural, chemical and biological methods are currently being used, and would continue to be used, to treat invasive plants on the MBS. Restoration of treated sites is also included in all alternatives.

Manual treatment refers to hand pulling and digging with tools such as a shovel or hoe to remove plants or cut off seed heads. Cultural treatments include tarping and competitive seeding. Chemical herbicides are used to kill plants and/or prevent seeds from germinating. Herbicide additives (adjuvants) such as surfactants may be used to improve effectiveness.

Table 3 shows the herbicide application methods currently approved.

Table 3. Herbicide application methods and descriptions

Application Method	Description
Selective spraying	Targets individual plants. Herbicide is usually applied by hand.
Spot Spraying	Targets individual to small clumps of plants. Herbicide is usually applied with a backpack sprayer or other hand pump system. Spot spraying is also done using a hose off a truck-mounted or ATV-mounted tank.
Broadcast spraying	Herbicide is applied to larger areas of invasive plants. This method is used when the invasive plant is dense enough that it is difficult to discern individual plants and the area to be treated makes spot spraying impractical. This method is currently approved for Skiyou Island only. Broadcast spraying is most often applied via a truck or ATV mounted hose or boom.

Biological control agents (biocontrols), generally insects, are distributed to help suppress or contain larger infestations. These agents attack and weaken targeted invasive plants and reduce their competitive or reproductive capacity. Biological control agents have been distributed locally for the following host species: Dalmatian toadflax, meadow and spotted knapweed, field bindweed, hawkweed, scotch broom, and St Johnswort. Table 4 displays the biological control agents (insects) currently occupying host species on the MBS.

Biological control agents are likely to suppress or contain an established population of invasive plants; however, other integrated treatments are usually necessary to control or eradicate populations over the long term.

United States Department of Agriculture-Agricultural Plant Health Inspection Service (USDA-APHIS) approves each step in the importation and release of biological control agents in the United States. Biological control agents undergo a rigorous testing procedure prior to being available for release. Initial testing occurs in quarantine laboratories abroad and in the United States. The agents are tested for their effectiveness in controlling the target organism, and for their host specificity.

NEPA decisions for the release and distribution of the agent in the United States (Beard and Carbone 2001), assuming that biological control agents would be distributed throughout North America to wherever the target species exists. Local redistribution of biological control agents is tiered to USDA - APHIS NEPA analysis. Release of biological control agents is not considered a site-specific action because "these agents are expected to occupy invasive plant hosts on National Forests regardless of any action the Forest Service may take (Beard and Carbone 2001)."For more information on biological control agents, please see the R6 2005 FEIS and its Appendix J.

Table 4. Biological control agents found on the MBS

Invasive Plant	Scientific Name Biocontrol Agent
bull thistle	*Urophora stylata*
Canada thistle	*Urophora cardui*
	Hadroplontus litura (formerly: Ceutorhynchus litura)
field bindweed	*Tyta luctuosa*
	Aceria malherbae
knapweeds	*Bangasternus fausti*
	Chaetorellia acrolophi
	Cyphocleonus achates
	Terellia virens
	Larinus minutus
	Larinus obtusus
	Urophora affinis
	Pelochrista medullana
	Pterolonche inspersa
	Sphenoptera jugoslavica
	Agapeta zoegana
orange hawkweed	*Aulacidea subterminalis*
Scotch broom	*Bruchidius villosus*
	Exapion fuscirostre

Invasive Plant	Scientific Name Biocontrol Agent
St. Johnswort	*Chrysolina hyperici*
	Chrysolina quadrigemina
	Agrilus hyperici
	Aplocera plagiata
tansy ragwort	*Longitarsus jacobaeae*
toadflax	*Mecinus janthinus*
	Brachypterolus pulicarius
	Calophasia lunula
	Gymnetron antirrhini

2.3 Alternative 1 – No Action

2.3.1 Introduction

2.3.1.1 Alternative 1 at a Glance

Treatment Methods	Manual, biological, and chemical (herbicide)
Herbicides Approved	Clopyralid, aquatic glyphosate and aquatic imazapyr. Metsulfuron methyl at Skiyou Island only.
Application Methods	Generally, selective or spot treatments with a backpack or hand tools. Broadcast is approved at Skiyou Island for glyphosate and metsulfuron methyl.
Acreage Limitation	No explicit acreage limitation.
EDRR Approach	A new annual newsletter is produced each spring, listing the new sites.

Under the No-Action Alternative , the MBS 2005 DN[9] and 2008 Skiyou Island Invasive Weeds Decision Notice (2008 Skiyou Island DN) would continue to guide invasive plant treatments within the project area (Forest). These decisions authorized the following treatments:

- Pulling, cutting or digging by hand or with non-motorized tools
- Use of biological control agents
- Cultural treatments such as competitive seeding and tarping
- Spot and selective herbicide using aquatic glyphosate, imazapyr, or clopyralid
- Use of the surfactant Agri-Dex®

[9] In 2008, based on a supplemental information report (2008 MBS SIR) the Forest Supervisor determined that use of two of the herbicides analyzed in the R6 2005 FEIS (clopyralid and imazapyr, in lieu of aquatic glyphosate on some sites) would not result in adverse effects outside of the scope of the 2005 MBS DN.

- broadcast application of glyphosate and metsulfuron methyl at Skiyou Island only
- restoration of treated sites

2.3.2 Integrated Treatment Prescriptions

Table 5 displays the common names of target species mapped on the MBS, the number of sites and total estimated acreage occupied by that species, herbicides currently approved for use, and the non-herbicide treatments that are likely to be used in combination with herbicide use or alone where effective.

Table 5. Integrated treatment prescriptions - Alternative 1 (No Action)

Common Name	Approximate Number of Sites	Approximate Acreage Infested	Herbicides Currently Approved	Effective Non-Herbicide Treatments (Alone or in Combination with Herbicide Use)
Absinth wormwood	1	2.2	clopyralid, aquatic glyphosate	Non-herbicide treatments are not effective.
Birds-foot trefoil	2	22	clopyralid, aquatic glyphosate	Manual digging. Removing flowering plants, non-flowering can be left on site to dry.
Bittersweet nightshade	1	<1	aquatic glyphosate, aquatic imazapyr	Manual digging. All plant parts should be removed from site.
Black locust	1	<1	aquatic glyphosate	Hand cutting.
Bull thistle	107	63	aquatic glyphosate, clopyralid	Effective biological control agents. Manual pulling and digging. Leave roots on site to dry, bag seed heads if present
Butterfly bush	15	22	aquatic glyphosate, imazapyr	Effective biological control agents. Manual pulling, digging and cutting. Rhizomatous, suckering plants, remove all plant parts from site.
Canada thistle	159	404	clopyralid, aquatic glyphosate	Effective biological control agents.
Common burdock	2	<1	clopyralid, aquatic glyphosate	Manual pulling and digging. Seeds to be removed from site, all other plant parts can remain on site.
Common comfrey	3	<1	clopyralid, aquatic glyphosate	Non-herbicide treatments are not effective.
Common groundsel	4	<1	clopyralid, aquatic glyphosate	Manual pulling and digging. Non-flowering plants can be left on site, remove plants that are in bud/flowering stage.
Common periwinkle	4	<1	aquatic glyphosate	Manual pulling, raking and digging. Can be left on site to dry.
Common tansy	19	73	aquatic glyphosate, metsulfuron methyl at Skiyou Island	Manual digging. Remove all flower/seed heads from site, all other plant parts can be left at site.
Common teasel	1	<1	clopyralid aquatic glyphosate	Non-herbicide treatments are not effective.
Cutleaf blackberry	12	32	aquatic glyphosate	Manual pulling and digging. All plant parts can be left on site to dry.
Dalmatian toadflax	8	24	aquatic glyphosate	Effective biological control agents. Manual pulling and digging. All parts except seeds can be left on site.

Common Name	Approximate Number of Sites	Approximate Acreage Infested	Herbicides Currently Approved	Effective Non-Herbicide Treatments (Alone or in Combination with Herbicide Use)
Diffuse knapweed	3	41	clopyralid, glyphosate	Effective biological control agents. Manual pulling and digging. All plant parts except flower/seed heads can remain on site.
Elephant ear/Japanese sweet coltsfoot	2	<1	aquatic glyphosate	Manual digging. Plant parts can be left on site to dry.
English holly	4	<1	aquatic glyphosate	Manual pulling and digging. Mechanical cutting. Plants can be left on site to dry.
English ivy	3	<1	aquatic glyphosate	Manual pulling and digging. Seeds removed, all other plant parts can be left on site to dry
European lily of the valley	1	<1	aquatic glyphosate	Manual digging. Remove all plant parts from site.
Field bindweed	4	<1	aquatic glyphosate	Effective biological control agents.
Giant hogweed	1	<1	aquatic glyphosate	Manual pulling and digging. Plant can be left on site, but should be removed in areas where the public may encounter the plant.
Hairy cat's ear	2	159	clopyralid, aquatic glyphosate	Manual digging. Competitive seeding. All but flower/seed heads can be left on site.
Hawkweed- Non-native (common, orange, yellow, spotted, smooth)	140	1,233	clopyralid, aquatic glyphosate	Effective biological control agents. Manual pulling and digging. All plant parts should be removed from site.
Hedge false bindweed	4	<1	aquatic glyphosate	Non-herbicide treatments are not effective.
Herb Robert	126	850	aquatic glyphosate	Manual pulling and digging. Plants not in flower can be left on site, all others removed.
Himalayan blackberry	14	55	aquatic glyphosate	Manual pulling and digging. All plant parts can be left on site to dry.
Jewelweed	1	3	aquatic glyphosate	Manual pulling. Plants in flower should be removed.
Knotweed (Bohemian, giant, Japanese)	74	892	aquatic glyphosate, aquatic imazapyr	Non-herbicide treatments are not effective.
Meadow knapweed	3	11	clopyralid, aquatic glyphosate	Effective biological control agents. Manual digging. All plant parts except flower/seed heads can remain on site.
Oxeye daisy	3	156	clopyralid, aquatic glyphosate	Manual pulling and digging. All plant parts except flowers can be left on site.

Common Name	Approximate Number of Sites	Approximate Acreage Infested	Herbicides Currently Approved	Effective Non-Herbicide Treatments (Alone or in Combination with Herbicide Use)
Poison hemlock	1	<1	aquatic glyphosate	Manual pulling and digging. Plant parts except seeds can be left on site.
Policeman's helmet	1	<1	aquatic glyphosate	Manual pulling and digging. Remove flower heads/seed from site.
Reed canary grass	3	121	aquatic glyphosate, aquatic imazapyr	Approved non-herbicide methods are not effective.
Rhubarb	1	<1	aquatic glyphosate, imazapyr, clopyralid	Manual digging. Plant can be left on site to dry.
Scotch broom	73	141	aquatic glyphosate	Effective biological control agents. Manual pulling and digging. All plants parts except those with seed pods can be left on site.
Spotted knapweed	32	173	clopyralid, aquatic glyphosate	Effective biological control agents. Manual pulling and digging. All plant parts except flower/seed heads can remain on site.
St. Johnswort	1	2	aquatic glyphosate	Effective biological control agents. Manual pulling and digging. Remove all plant parts from site.
Sulphur cinquefoil	12	75	aquatic glyphosate	Manual pulling and digging. All plant parts except seeds can be left on site.
Tansy ragwort	75	319	clopyralid, aquatic glyphosate, metsulfuron methyl at Skiyou Island	Effective biological control agents. Manual pulling and digging. All flowering parts, including those not yet in bloom, removed from site.
Wild carrot	4	2	aquatic glyphosate	Manual pulling. Remove flower/seeds from site.
Woolly hedgenettle	1	<1	aquatic glyphosate, aquatic imazapyr	Manual pulling and digging. Remove all plant parts from site.
Yellow archangel	6	<1	aquatic glyphosate, aquatic imazapyr	Manual pulling and digging. Remove all plant parts from site.
Yellow flag iris	1	<1	aquatic glyphosate, aquatic imazapyr	Manual pulling and digging. Remove rhizomes and seeds from site.
Estimated Total[1]	935	4,878		

[1]Infested acreage is imprecise and likely to far overestimate the extent of inventoried target species. Some of the target species co-occur within infested acres.

2.3.3 Management Requirements and Mitigation Measures (MR/MM)

The following Management Requirements and Mitigation Measures (MR/MM) would continue to apply to invasive plant treatments.

General

1. In treating any/all infestations, all applicable management requirements and practices, included in the Forest Plan Prevention Strategy, Best Management Practices (BMPs) for invasive plants will be followed.[10]
2. In particular, after working in invasive plant sites, all tools, equipment, and gear must be cleaned (power wash or high pressure spraying) before leaving the area, in order to avoid spreading the infestation further.
3. All invasive species management must be coordinated with all other site or area resources objectives.
4. Biocontrol treatments will use only those control agents that have been approved by the U.S. Department of Agriculture Animal and Health Inspection Service and permitted by the State of Washington.
5. Any mulch used must be approved as invasive plant free, meeting the Forest Plan, Forestwide Standards and Guidelines, Prevention Strategy and BMPs.[11]

General Herbicide Use

6. No broadcast spraying (aerial or boom) will occur.
7. Any preparation, transport, or application of herbicide will be done by trained workers with a current Washington State pesticide applicators license.
8. Only the aquatic formulation of glyphosate will be used, and at the lowest effective rate as per manufacturer label specifications, which is estimated to be 2.5 to 5 percent solution of the aquatic formulation of glyphosate diluted in water (3 ounces manufacturer's concentrate per gallon of water). Refer to Mitigation Measure #19, below, for application via stem injection.[12]
9. If needed, the only surfactant that will be used is Agri-Dex®.
10. Pretreatment briefings will be conducted with all herbicide applicators to emphasize safety requirements, clarify treatment objectives and all mitigation measures, and to clarify identification of both target and non-target species.

Herbicide and Surfactant Transport, Mixing, Use

11. Materials Safety Data Sheets, and Forest Service Information covering glyphosate and Agri-Dex® must be carried in each vehicle at all treatment times, and made available to interested members of the public, on-site.
12. Glyphosate and Agri-Dex® containers must be secured and prevented from tipping during transport.
13. Workers will carry only enough herbicide daily to cover the proposed treatment for that day.

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[10] This Forest Plan guidance was updated by the R6 2005 ROD Standards.
[11] This Forest Plan guidance was updated by the R6 2005 ROD standards.
[12] In 2008, the Forest Supervisor authorized use of two additional herbicides (clopyralid and imazapyr), finding that use of these herbicides would have effects within the scope of the MBS 2005 DN.

14. Mix only the amount of solution needed to complete daily treatments.
15. Workers will follow all herbicide label guidelines.
16. Containment mats will be used during mixing, to further avoid the risk of a spill.
17. Do not mix glyphosate or glyphosate with Agri-Dex® within 300 feet of riparian areas, wetlands, or surface water.
18. When glyphosate (with Agri-Dex®) is administered via wand-backpack spray, hand wiped, or painted on cut stems, the applicator will use the lowest effective rate
19. For stem injection: only the lowest effective dose will be used on the MBS. The current recommended effective dose is 100 percent of the manufacturer's concentrate. Trial studies suggest that 2 to 3 milliliters per stem can be effective (The Nature Conservancy 2004, Clallam County 2004). New preliminary research has found that 2.5 milliliters per stem is effective (personal communication, Dr. Timothy Miller, Washington State University Extension Service. Mt. Vernon, WA. May 2005)
20. Stem injection method would only be used on very small, high-priority infestations with difficult access.
21. No applications using wand-backpack spray will occur when wind speed exceeds five miles per hour, to lessen drift, or when precipitation is expected within 24 hours.
22. No hand wiping of leaves with the aquatic formulation of glyphosate with Agri-Dex® will be done when precipitation is expected within 24 hours.
23. Application will occur only outside of timing constraints for wildlife, and when the chance of rain after application is very low.
24. Herbicide mixture aquatic formulation of glyphosate with or without Agri-Dex® will be colored with a bright, non-toxic vegetable dye before application. This will (a) minimize the possibility of accidentally applying herbicide to non-target species; (b) minimize the amount of herbicide used, by avoiding re-application to plants that have already been treated; and (c) assist anyone who might be gathering forest products or near a treatment area (public or tribe) in identifying plants and areas that should be temporarily avoided.

Soils/Water/Fisheries

25. Soil disturbance (e.g., hand digging, grubbing, pulling) will be minimized to the extent possible. Restoration of treated areas will follow the restoration treatment proposed for each site.
26. As noted above [measure 17], all herbicide spray mixtures (aquatic formulation of glyphosate with or without Agri-Dex®) would not be prepared within 300 feet of riparian areas, wetlands, or surface water.
27. Containment mats will be used during mixing to further avoid the risk of a spill.
28. Any mulch used must be approved as invasive plant free, meeting the Forest Plan, Forest-wide Standards and Guidelines, Prevention Strategy and BMPs.[13]

[13] This standard was updated by the R6 2005 ROD.

Wildlife

29. From January 1 through August 15, restrict all treatment activity in known or suspected bald eagle nest territories.
30. Baker River Inlet to Baker Lake, Site 106: from November 1 through March 31, restrict all treatment activity near known, occupied eagle roost sites or key eagle foraging areas.
31. From March 1 through July 15, restrict activities generating noise above ambient levels within 35 yards of suitable spotted owl nesting habitat.
32. From April 1 through August 5, restrict activities generating noise above ambient levels within 35 yards of suitable marbled murrelet nesting habitat.
33. For infestation treatments located within or adjacent to suitable nesting habitat for murrelets, leaving garbage or trash in the area is prohibited.

Vegetation, Plants

34. MBS Botanists will consistently provide training to contractors, state-wide, to educate them on accurate identification of invasive plants, so that only target species are treated and other desirable species are left unharmed.
35. If any previously undiscovered rare plants are found within the project area, work will be halted until the Forest Service botanist is consulted and necessary mitigation measures are enacted.

Heritage Resources

36. An information packet will be provided to all personnel involved in the invasive plant treatment prior to project implementation. The packet will contain information on heritage resource identification (e.g., railroad grades, how to identify prehistoric artifacts) and instructions for any historic or prehistoric resources that may be found.
37. If a previously unidentified resource is discovered during project implementation—under any treatment method—or if at any time a resource that may be eligible for the National Historic Register of Historic Places is affected in an unanticipated way, reasonable steps will be taken to avoid or minimize harm to the resource until the Forest Service can fulfill its consultation requirements in accordance with the Programmatic Agreement for Heritage Resources (1997) (see project files).

Recreation, Public Use

38. For any site where recreation use or activity is high and invasive plant infestations are located other than along the peripheral (e.g., edges of parking lots, along road shoulders), any treatment using the aquatic formulation of glyphosate (with or without Agri-Dex®) will occur only during the week, and not on weekends or 3-day holiday weekends. Sites will be signed and flagged.
39. The only two examples [requiring special mitigation for recreation/public use] among the 91 specific sites proposed for treatment are Gold Creek Pond (polygon # 48) and Buck Creek Camp (polygon # 148). While Buck Creek Camp is not operating for the 2005 season (camp is for sale), any treatment using the aquatic formulation of glyphosate (with or without Agri-Dex®) will be contingent upon scheduling with the Camp management, or the care-taker.

Worker and Public Health and Safety

40. All workers will comply with Occupational Health and Safety Administration (OSHA) standards, Forest Service Health and Safety Code Handbook, and other guidelines, BMPs, and manufacturers' recommendations to reduce the risk of injury to workers.

2.3.4 Early Detection Rapid Response

The MBS 2005 EA included the following elements in a “New Invader Strategy”:

- Based on the previous year’s surveys, new invasive plant infestations would be documented [using the forms in Appendix D of the 2005 EA].
- New infestation sites would be prioritized.
- The current “set” of high-priority sites would be included in each year’s prioritization, which could result in a newly-discovered site being ranked as a higher priority for treatment.
- Once a new site is ranked as a high priority, an initial proposed treatment and restoration plan would be selected, based on the type of invasive plant, size of infestation, and location. Tools to make this assessment would include, but not be limited to: the biology of each invasive plant species and their control history [Appendix C of the 2005 MBS EA]; and MBS specific experience with treating invasive species [Appendix B, of the 2005 MBS EA]. The only treatment methods available for selection would be those included in the [2005 MBS] EA, along with all Management Requirements and Mitigation Measures.
- A new annual newsletter would be produced each spring, listing the new sites. It would be mailed to all interested parties, including agencies (such as USDI Fish and Wildlife Service (FWS), and NOAA Fisheries[14]), Tribes, and others. Comments would be solicited.
- For each new, high-priority site: the effects on other resources from treatment/restoration would be estimated. This information would be included in the newsletter.
- If the effects are found to be within the scope of this EA, and USFWS and NOAA Fisheries concur through informal Section 7 (ESA) consultation, sites would be added as addenda.
- All treatments would be accomplished as funding is available.

2.3.5 Monitoring

Under the No-Action Alternative, treatment effectiveness monitoring would continue following national protocols established under the Forest Service National Resource Inventory System (NRIS).

[14] Currently, this agency is referred to as National Marine Fisheries Service (NMFS).

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2.4 Alternative 2 – Proposed Action

2.4.1 Introduction

2.4.1.1 Alternative 2 at a Glance

Treatment Methods	Manual, mechanical, cultural, chemical (herbicide) and biological. Restoration of treated sites.
Herbicides Approved	Herbicide formulations containing 1 or more of the following 10 active ingredients: aminopyralid, chlorsulfuron, clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, picloram, sulfometuron methyl, and triclopyr. Of these, aminopyralid, triclopyr, and metsulfuron methyl are first year/first choice herbicides that are not currently in use on the MBS[1].
Forest Plan Amendment	Yes, to add aminopyralid to the list of authorized herbicides.
Application Methods	Selective, spot, or broadcast treatments.
Treatment Acreage Limitations	Annually, treatment using herbicide would not exceed about 5,000 infested acres per year and no more than 13,500 acres of new detections would be treated with herbicide over the life of the project (based on approximately 10 percent spread per year for 10 years).[15] No more than 18% of the area within 150 feet of any flowing stream would be treated with herbicide annually (10 acres per 1.5 miles of stream).
EDRR Approach	Develop site prescriptions and address any resources of concern. Follow herbicide use decision criteria to determine preferred method. Integrate MR/MM into implementation prescription based on site conditions. Treat as soon as possible after finding new sites. Treatments would not be limited to those identified in a pre-season report.

[1]Metsulfuron methyl is currently approved for use at Skiyou Island based on the 2008 Invasive Weed Treatment DN.

Alternative 2 (Proposed Action) includes:

- Use any of nine herbicides that were analyzed in the R6 2005 FEIS, alone or in combination with manual, mechanical, biological and cultural methods.
- Management requirements and mitigation measures (MR/MM).
- Amendment of the MBS Forest Plan to allow for use of an additional herbicide, aminopyralid (Milestone®; Milestone VM®), to increase treatment effectiveness.
- Approval of the broadcast method of application where needed. Most of the proposed herbicides would not be broadcast near streams and other water bodies or in other sensitive areas.
- Allow for invasive plant treatment in wilderness areas using any of the treatment methods except broadcast herbicide application and mechanical removal.
- Allow for mechanical (mowing and string trimming) treatments where appropriate outside wilderness.

Alternative 2 would replace the “new invader strategy” with an Early Detection, Rapid Response (EDRR) process. The EDRR process would ensure that treatment prescriptions and MR/MM are appropriately applied to new sites.

[15] The 13,500 acre limit applies specifically to new detections found during the life of the project. It does not infested areas that are currently mapped. This measure has been edited for clarity.

Table 6 details proposed integrated treatment prescriptions for each invasive species. Additional information about each invasive species site is on file at the Mount Baker-Snoqualmie National Forest Headquarters. Treatments are often a combination of methods, such as herbicide/manual or cultural/manual. More herbicide options may be available for any given site with the action alternatives, compared to No Action, and there might be more flexibility in the method of application. However, all treatments would be done according to the Management Requirements and Mitigation Measures (MR/MM) listed in Table 9 and would follow the herbicide use buffers near streams and other water bodies shown in Table 10.

2.4.2 Forest Plan Amendment

The Proposed Action would add aminopyralid to the list of approved ingredients in Standard 16 for the MBS NF (non-significant Forest Plan amendment). All other standards and guidelines for invasive plant management would not change.

Currently Standard 16 reads:

> *Select from herbicide formulations containing 1 or more of the following 10 active ingredients: chlorsulfuron, clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, picloram, sethoxydim, sulfometuron methyl, and triclopyr…Additional herbicides and herbicide mixtures may be added in the future at either the Forest Plan or project level through appropriate risk analysis and NEPA/ESA procedures.*

Standard 16 would be amended to read (*additions/changes in italics*):

> *Select from herbicide formulations containing 1 or more of the following 11 active ingredients: aminopyralid, chlorsulfuron, clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, picloram, sethoxydim, sulfometuron methyl, and triclopyr…Additional herbicides and herbicide mixtures may be added in the future at either the Forest Plan or project level through appropriate risk analysis and NEPA/ESA procedures.*

2.4.3 Integrated Treatment Prescriptions

No single treatment method is ideal for all invasive plant control situations. The Proposed Action would include a combination of effective and practical integrated treatments depending on the target species, location and other site conditions. Treatment options for each target species would be increased compared to Alternative 1; in addition to chemicals already in use on the MBS, a wider variety of herbicides and adjuvants could be used. Mechanical mowers and string trimmers could be used as in areas outside of wilderness.

Table 6 displays the herbicides that are likely to be effective for each known target species on the Forest. Table 7 totals acres for each of the first year/first choice treatments. The “first choice” herbicides would generally be the preferred entry for the first year on each known site. However, during implementation, the “other possible herbicides” may be used in place of the first choice, depending on site conditions at the time of treatment. Regardless of whether a given herbicide is the first choice or among the other effective choices, the Management Requirements and Mitigation Measures (MR/MM - Table 9) and herbicide use buffers that apply to the herbicide selected for use would be implemented. As long as the MR/MM and herbicide use buffers were followed, any of the 10 proposed herbicides may be used at any site.

Table 6. Integrated Treatment Prescriptions – Alternative 2 (Proposed Action)

Target species (Common Name)	Approx. Number of Sites	Approx. Acreage Infested 1	First Choice Herbicide (those NOT available in current program are bolded)	Other Possible Herbicides (those NOT available in current program are bolded)	Effective Non-Herbicide Treatments (alone or in combination with herbicide use)
Absinth wormwood	1	2	**Aminopyralid**	Clopyralid Glyphosate	Non-herbicide treatments are not effective.
Birds-foot trefoil	2	22	Clopyralid	**Aminopyralid** **Triclopyr** Glyphosate	Manual digging. Removing flowering plants, non-flowering can be left on site to dry.
bittersweet nightshade	1	<1	Glyphosate	Imazapyr **Triclopyr** **Imazapic**	Manual digging. All plant parts should be removed from site.
Black locust	1	<1	**Triclopyr**	Glyphosate	Hand cutting
Bull thistle	107	63	**Aminopyralid**	Glyphosate **Triclopyr** Clopyralid	Effective biological control agents. Manual pulling and digging. Leave roots on site to dry, bag seed heads if present
Butterfly bush	15	22	Glyphosate	**Triclopyr** Imazapyr	Effective biological control agents. Manual pulling, digging and cutting. Rhizomatous, suckering plants, remove all plant parts from site.
Canada thistle	159	404	**Aminopyralid**	**Picloram** Clopyralid Glyphosate **Chlorsulfuron**	Effective biological control agents.
Common burdock	2	<1	**Triclopyr**	Clopyralid Glyphosate **Aminopyralid**	Manual pulling and digging. Seeds to be removed from site, all other plant parts can remain on site.
Common comfrey	3	<1	Glyphosate	Clopyralid	Non-herbicide treatments are not effective.
Common groundsel	4	<1	Clopyralid	Glyphosate	Manual pulling and digging Non-flowering plants can be left on site, remove plants that are in bud/flowering stage.
Common periwinkle	4	<1	Glyphosate	**Triclopyr** **Picloram**	Manual pulling, raking and digging. Can be left on site to dry.

Target species (Common Name)	Approx. Number of Sites	Approx. Acreage Infested 1	First Choice Herbicide (those NOT available in current program are bolded)	Other Possible Herbicides (those NOT available in current program are bolded)	Effective Non-Herbicide Treatments (alone or in combination with herbicide use)
Common tansy	19	73	**Metsulfuron methyl** (Approved Currently At Skiyou Island)	**Chlorsulfuron** Glyphosate	Manual digging. Remove all flower/seed heads from site, all other plant parts can be left at site.
Common teasel	1	<1	**Triclopyr** Clopyralid\	Glyphosate **Metsulfuron methyl** **Chlorsulfuron** **Imazapic**	Non-herbicide treatments are not effective.
Cutleaf blackberry	12	32	**Triclopyr**	Glyphosate	Manual pulling and digging. All plant parts can be left on site to dry.
Dalmatian toadflax	8	24	**Chlorsulfuron**	**Picloram** **Imazapic** **Metsulfuron methyl** Glyphosate	Effective biological control agents. Manual pulling and digging. All parts except seeds can be left on site.
Diffuse knapweed	3	41	**Aminopyralid**	Clopyralid **Triclopyr** Glyphosate **Picloram**	Effective biological control agents. Manual pulling and digging. All plant parts except flower/seed heads can remain on site.
Elephant ear/Japanese sweet coltsfoot	2	<1	Glyphosate	Glyphosate	Manual digging. Plant parts can be left on site to dry.
English holly	4	<1	Glyphosate	Glyphosate	Manual pulling and digging. Mechanical cutting. Plants can be left on site to dry.
English ivy	3	<1	**Triclopyr**	Glyphosate	Manual pulling and digging. Seeds if present, to be removed, all other plant parts can be left on site to dry
European lily of the valley	1	<1	Glyphosate	**Metsulfuron methyl** **Chlorsulfuron**	Manual digging. Remove all plant parts from site.
Field bindweed	4	<1	Glyphosate	**Triclopyr** **Picloram**	Effective biological control agents.
Giant hogweed	1	<1	Glyphosate	**Triclopyr**	Manual pulling and digging. Plant can be left on site, but should be removed in areas where the public may encounter the plant.

Target species (Common Name)	Approx. Number of Sites	Approx. Acreage Infested 1	First Choice Herbicide (those NOT available in current program are bolded)	Other Possible Herbicides (those NOT available in current program are bolded)	Effective Non-Herbicide Treatments (alone or in combination with herbicide use)
Hairy cat's ear	2	159	Clopyralid	Glyphosate **Picloram**	Manual digging. Competitive seeding. All but flower/seed heads can be left on site.
hawkweed – Non-native (common, orange, yellow, spotted, smooth, tall)	140	1,233	**Aminopyralid**	Clopyralid **Triclopyr** Glyphosate	Effective biological control agents. Manual pulling and digging. All plant parts should be removed from site.
Hedge false bindweed	4	<1	Glyphosate	**Triclopyr** **Picloram**	Non-herbicide treatments are not effective.
Herb Robert	126	850	Glyphosate	Glyphosate	Manual pulling and digging. Plants not in flower can be left on site, all others removed.
Himalayan blackberry	14	55	**Triclopyr**	Glyphosate	Manual pulling and digging. All plant parts can be left on site to dry.
Jewelweed	1	3	Glyphosate	**Triclopyr** **Metsulfuron methyl**	Manual pulling. Plants in flower should be removed.
Knotweed (Bohemian, giant, Japanese)	74	892	Glyphosate Imazapyr	Glyphosate Imazapyr	Non-herbicide treatments are not effective.
Meadow knapweed	3	11	**Aminopyralid**	Clopyralid **Triclopyr** Glyphosate **Picloram**	Effective biological control agents. Manual digging. All plant parts except flower/seed heads can remain on site.
Oxeye daisy	3	156	**Aminopyralid**	Clopyralid **Picloram** Glyphosate	Manual pulling and digging. All plant parts except flowers can be left on site.
Poison hemlock	1	<1	Glyphosate	**Metsulfuron methyl** **Triclopyr**	Manual pulling and digging. Plant parts except seeds can be left on site.
Policeman's helmet	1	<1	Glyphosate	**Triclopyr** **Metsulfuron methyl**	Manual pulling and digging. Remove flower heads/seed from site.
Reed canary grass	3	121	Glyphosate	**Sulfometuron methyl** Imazapyr	Approved non-herbicide methods are not effective.
Rhubarb	1	<1	Glyphosate	Imazapyr Clopyralid	Manual digging. Plant can be left on site to dry.

Target species (Common Name)	Approx. Number of Sites	Approx. Acreage Infested 1	First Choice Herbicide (those NOT available in current program are bolded)	Other Possible Herbicides (those NOT available in current program are bolded)	Effective Non-Herbicide Treatments (alone or in combination with herbicide use)
Scotch broom	73	141	**Aminopyralid**	Glyphosate **Triclopyr**	Effective biological control agents. Manual pulling and digging and mechanical cutting. All plants parts except those with seed pods can be left on site.
Spotted knapweed	32	173	**Aminopyralid**	**Picloram** **Triclopyr** Clopyralid Glyphosate	Effective biological control agents. Manual pulling and digging. All plant parts except flower/seed heads can remain on site.
St. Johnswort	1	2	**Aminopyralid**	**Picloram** **Metsulfuron methyl** Glyphosate	Effective biological control agents. Manual pulling and digging. Remove all plant parts from site.
Sulphur cinquefoil	12	75	**Metsulfuron methyl**	**Picloram** Glyphosate **Triclopyr** **Aminopyralid**	Manual pulling and digging. All plant parts except seeds can be left on site.
Tansy ragwort	75	319	**Aminopyralid**	**Picloram** Metsulfuron methyl Clopyralid Glyphosate Triclopyr	Effective biological control agents. Manual pulling and digging. All flowering parts, including those not yet in bloom, removed from site.
Wild carrot	4	2	**Metsulfuron methyl** (Approved Currently At Skiyou Island)	**Chlorsulfuron** **Triclopyr** Glyphosate	Manual pulling. Remove flower/seeds from site.
Woolly hedgenettle	1	<1	Glyphosate	**Triclopyr** Imazapyr	Manual pulling and digging. Remove all plant parts from site.
Yellow archangel	6	<1	Glyphosate	**Triclopyr** Imazapyr **Metsulfuron methyl**	Manual pulling and digging. Remove all plant parts from site.
Yellow flag iris	1	<1	Imazapyr	Glyphosate	Manual pulling and digging. Remove rhizomes and seeds from site.
Estimated Total[1]	935	4,878			

[1]Infested acreage is imprecise and likely to far overestimate the extent of inventoried target species. Some of the target species co-occur within infested acres.

Table 7. Total acres for each first year/first choice treatment under Alternative 2

First Year/First Choice Treatment	Total Acres
biocontrol	80
manual	101
aminopyralid	2,368
clopyralid	180
chlorsulfuron	24
glyphosate	1,068
glyphosate/imazapyr mix	892
metsulfuron methyl	150
triclopyr	15

Approximately 2,470 acres of known sites are currently of a size or density great enough to warrant broadcast application. The first year/first choice herbicides for broadcast sites in the current inventory include aminopyralid, clopyralid, glyphosate, and metsulfuron methyl (Table 8). Over time, other herbicides may be broadcast if needed, as long as MR/MM and herbicide use buffers are followed. In accordance with the R6 2005 ROD Standard #16, no broadcast of triclopyr would be authorized. This acreage does not consider the influence of MR/MM and herbicide use buffers (Table 9 and Table 10) that prohibit broadcasting of herbicides near streams and other sensitive areas (for example "roads that have a higher risk of herbicide delivery to fish bearing streams").

Table 8. Herbicide active ingredient and estimated broadcast acres

First Year/First Choice Herbicide Active Ingredient/Target species	Estimated Broadcast Acres for Known Sites
Aminopyralid	
Canada thistle	293.7
Common hawkweed	599.9
Diffuse knapweed	9.9
Meadow hawkweed	143.4
Orange hawkweed	159.0
Oxeye daisy	155.2
Scotch broom	62.7
Smooth hawkweed	62.5
Spotted hawkweed	31.5
Spotted knapweed	46.7
St. Johnswort	1.6
Tansy ragwort	107.4
Yellow hawkweed	138.6
Acres Broadcast Aminopyralid	***1,812.1***
Clopyralid	
Hairy cat's ear	158.4
Acres Broadcast Clopyralid	***158.4***
Glyphosate	

First Year/First Choice Herbicide Active Ingredient/Target species	Estimated Broadcast Acres for Known Sites
Cutleaf blackberry	24.9
Herb Robert	167.3
Himalayan blackberry	46.1
Reed canarygrass	120.3
Acres Broadcast Glyphosate	***358.6***
Metsulfuron methyl	
Common tansy	67.5
Sulphur cinquefoil	73.7
Acres Broadcast Metsulfuron Methyl	***141.2***
Total Estimated Acres-Broadcast	***2,470.3***

2.4.4 Post-Treatment Restoration (Revegetation)

Revegetation would occur following treatment if needed to restore native plant communities. Each treatment site was classified into one of five categories:

1. **None**. These are areas where revegetation is either not desirable, or not realistic, or inappropriate. For instance, revegetation would not be desirable in a naturally unvegetated area such as a gravel bar. Revegetation would not be realistic if the area is constantly being graded or cleared such as a gravel pit. Revegetation would not be appropriate in cases such as a tree climbing vine like ivy or clematis.
2. **Passive Revegetation.** Site is expected to revegetate naturally because there are enough native species (or desirable non-natives such as within lawns in administrative sites) in the immediate vicinity to colonize once the weeds are killed. Site types include vegetated road shoulders and small areas in forested sites.
3. **Seed and Mulch**. This is the prescription for use where there are not enough native species in the immediate vicinity to colonize once the weeds are killed but planting is not prescribed. Examples include areas targeted for broadcast treatment. Use local native seed mix if possible, otherwise use MBS non-invasive non-native species (per Potash and Aubry 1999, as amended in 2003).
4. **Plant Rooted Stock**. For specific restoration projects or where the weed has to be excavated in order to control it (i.e. first-choice/ first-year treatment is dig or where large areas of shrub-like weeds occur).
5. **Planted in the Past**. Some examples include portions of Marblemount Boat Launch, Ovenell Property, Kaaland Acquisition, Skiyou Island.

Please see Appendix B for a list of treatment sites and the restoration that would be applied to each site. Active restoration is recommended for about 2,636 acres.

2.4.5 Management Requirements and Mitigation Measures (MR/MM)

The Proposed Action would include the Management Requirements and Mitigation Measures (MR/MM) listed in Table 9. Some of the MR/MM have been refined or clarified between issuance of the draft and final EIS documents. One substantive change is elimination of use of POEA surfactants.

Table 9. Management Requirements and Mitigation Measures

MR/MM ID	Management Requirements and Mitigation Measures	Objective
	General	
1	Coordinate herbicide use within 1000 feet (slope distance) of known water intakes with the water user or manager.	To ensure that water users are informed about nearby herbicide use.
2	Coordinate herbicide use with Municipal Water boards. Herbicide use or application method may be excluded or limited in some areas.	To ensure that water users are informed about nearby herbicide use and standards for municipal watersheds are met.
3	Pretreatment briefings would be conducted with all herbicide applicators to emphasize safety requirements, clarify treatment objectives and all mitigation measures, and to clarify identification of both target and non-target species.	To ensure applicators are aware of project requirements.
4	Lowest effective herbicide use rates would be used for each treatment situation. Nonylphenol ethoxylate-based non-ionic (NPE) and POEA surfactants would not be used. Vegetable oils and silicone blends that contain alkylphenol ethoxylate ingredients may be used.	To minimize possible herbicide or surfactant exposures of concern to human health.
5	After working in invasive plant sites, all tools, equipment, and gear must be cleaned (power wash or high pressure spraying) before leaving the area. Any mulch used must be approved as invasive plant free. Non-invasive plants (preferably native plants) would be used for restoration where needed.	To prevent the spread of invasive plants during treatment operations.
6	Herbicide mixture would be colored with a bright, non-toxic vegetable dye before application.	To (a) minimize the possibility of accidentally applying herbicide to non-target species; (b) minimize the amount of herbicide used, by avoiding re-application to plants that have already been treated; and (c) assist anyone who might be gathering forest products or near a treatment area (public or Tribe) in identifying plants and areas that should be temporarily avoided.
7	Do not apply herbicides when local weather forecast calls for a ≥ 80% chance of rain. Do not broadcast spray when wind speed at the site is in excess of 5 mph. Weather conditions would be monitored periodically during operations. 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.	To reduce potential for off-site herbicide drift and run off.

MR/MM ID	Management Requirements and Mitigation Measures	Objective
8	**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. At a minimum the plan would: ü Address spill prevention and containment. ü Require that impervious material be placed beneath mixing areas in such a manner as to contain small spills associated with mixing/refilling. ü Require a spill cleanup kit be readily available for herbicide transportation, storage and application (minimum FOSS Spill Tote Universal or equivalent). ü Outline reporting procedures, including reporting spills to the appropriate regulatory agency. ü Ensure applicators are trained in safe handling and transportation procedures and spill cleanup. ü Require that equipment used in herbicide storage, transportation and handling are maintained in a leak proof condition. ü Address transportation routes so that traffic, domestic water sources, and blind curves are avoided to the extent possible. ü Specify conditions under which guide vehicles would be required. ü Ensure safe disposal of herbicide containers. ü Identify sites that may only be reached by water travel and limit the amount of herbicide that may be transported by watercraft. ü Workers would carry only enough herbicide daily to cover the proposed treatment for that day. ü See soil, water and fisheries MR/MMs for additional measures	To reduce likelihood of spills and contain any spills.
	Botanical	
9	Surveys would be conducted for botanical species of conservation concern prior to invasive plant treatments **if**: (1) the area has not already been surveyed for these species, (2) if the area contains likely habitat for any of these species, **and** (3) if the proposed treatments are likely to have a negative impact to individual plants. Surveys would be conducted in the area within 30 feet from where use of herbicides is planned. If species of concern are located, then mitigation measures for that species and that herbicide will be applied.	To ensure surveys are conducted for botanical species of conservation concern when circumstances warrant.
10	Follow mitigation measures for botanical species of conservation concern known to be within 30 feet of invasive plant treatment sites (see Table 31 in Chapter 3.3). Site-specific mitigation measures would be developed for unknown newly discovered botanical species of conservation concern within 30 feet of treatment sites.	To ensure appropriate steps are taken to protect botanical species of conservation concern when herbicide is being used to treat invasive plants.
11	A botany specialist will coordinate with applicators to ensure botanical species of conservation concern are protected. Treatments will be monitored for efficacy and refined as needed.	Ensure that botanical species of conservation concern are not adversely affected by treatments.
12	For herbicide treatment, use protective measures such as low-pressure spot-spray, directed spray applications, backpack applications, and/or protective barrier for botanical species of conservation concern. If buffers are needed to protect botanical species of conservation concern, the following guidance will be followed:	Minimize likelihood of herbicides inadvertently reaching botanical species of conservation concern.

MR/MM ID	Management Requirements and Mitigation Measures	Objective
	· Greater than 30 feet: All application methods permitted. All herbicides are permitted. · Between 30 and 0 feet: No use of chlorsulfuron, imazapic, metsulfuron methyl, sulfometuron methyl, or picloram permitted. Clopyralid, aminopyralid, and triclopyr may be used if plant is not susceptible to these selective herbicides. Spot spray of glyphosate may be used if the rare plant is shielded or covered and botanist is on site.	
13	Do not apply imazapic to areas treated within the previous 18 months with chlorsulfuron, metsulfuron methyl, sulfometuron methyl, or imazapyr in areas where reseeding of susceptible species is to occur.	To avoid damage to non-target plants. Label caution states "for the previous year". 18 months provides higher level of protection.
14	In order to protect botanical species of conservation concern in saturated or wet soils at the time of application, do not use picloram or imazapyr due to their mobility. Under saturated or wet soil conditions present at the time of treatment, only hand application of herbicide is permitted within 10 feet of botanical species of conservation concern.	Protect botanical species of conservation concern from impacts of certain herbicides.
15	Do not broadcast sulfonylurea herbicides within 50 feet of botanical species of conservation concern.	Protect botanical species of conservation concern from impacts from sulfonylurea herbicides through air (drift).
	Soils, Water and Fisheries (includes Water Quality Best Management Practices)	
16	The following treatment methods are shown in order of preference (if effective and practical), within roads that have higher risk of herbicide delivery to fish habitat and adjacent alluvial floodplains: (1) Non-herbicide (e.g., hand pulling). (2) Application of aminopyralid, clopyralid, imazapic, and metsulfuron methyl, aquatic glyphosate, aquatic triclopyr, aquatic imazapyr. (3) Application of chlorsulfuron, imazapyr, sulfometuron methyl. (4) Application of non-aquatic glyphosate. No picloram or non-aquatic triclopyr BEE would be used on roads that have a higher risk of herbicide delivery to fish habitat.	To protect aquatic organisms by favoring lower risk methods where effective on roads that have a higher risk of herbicide delivery to fish habitat. Appendix D displays a list and maps of roads considered higher risk. Roads are considered higher risk for herbicide delivery to fish bearing streams if any portion of the road segment comes within 200 feet of a fish bearing stream.
17	Only aquatic glyphosate, aquatic imazapyr, aminopyralid, clopyralid, imazapic, and metsulfuron methyl may be applied with a broadcast method on roads that have a higher risk of herbicide delivery to fish bearing streams. Portions of high risk roads may be cleared for use of picloram or non-aquatic triclopyr or broadcast spraying of chlorsulfuron, imazapyr, sulfometuron methyl based on a site review by an aquatics specialist to ensure the roadside ditches are not hydrologically connected to streams.	To ensure herbicide is not delivered to streams in concentrations that exceed levels of concern.
18	The following herbicides may be spot or hand/selectively applied within 15 feet of any wet roadside ditch: Aquatic labeled glyphosate, aquatic labeled imazapyr, aquatic labeled triclopyr, aminopyralid, imazapic, clopyralid and metsulfuron methyl. No use of chlorsulfuron, picloram or sulfometuron methyl would occur within 15 feet of a wet roadside ditch.	To ensure herbicide is not delivered to streams in concentrations that exceed levels of concern.
19	Total treatment area would not exceed 10% of Riparian Reserves within a 6th field sub-watershed in any given year.	Limits the extent of treatment near water so that effects are within the scope of analysis.

MR/MM ID	Management Requirements and Mitigation Measures	Objective
20	Lakes and Ponds – No more than half the perimeter or 50 percent of the vegetative cover or 10 contiguous acres around a lake or pond would be treated with herbicides in any 30-day period.	To reduce exposure to herbicides and uncertainty regarding effects to reptiles and amphibians by providing some untreated areas for some organisms to use.
21	Equipment fueling sites would be at least 150 feet from lakes, wetlands, or stream channels.	To minimize risk of fuel entering water. Width incorporates aquatic influence zone.
22	All herbicide storage, chemical mixing, refilling and post-application equipment cleaning would be performed at least 300 feet from live water, domestic wells, or domestic spring boxes, and in such a manner as to prevent the potential contamination of any riparian area, perennial or intermittent waterway, ephemeral waterway, wetland, or drinking water.	Reduce potential for adverse effects from accidental spills. 300 feet includes largest Riparian Reserve. Incorporates Washington State wellhead protection protocol.
23	POEA would not be used. Select from the list of surfactants approved by the Dept. of Ecology for use in aquatic environments for treatments within 100 feet of streams (see Appendix E).	Eliminates use of higher risk surfactant.
24	Avoid using picloram, imazapyr and/or metsulfuron methyl sulfometuron methyl on bare or compact soils that are highly disturbed.	To preserve site recovery after disturbance, lessen offsite runoff and leaching. Poor soils will have longer residence times with these persistent herbicides.
25	For soils with seasonally high water tables, do not use picloram or triclopyr BEE and limit glyphosate use to aquatic label only.	Reduce the risk for contamination of groundwater and offsite runoff to aquatic habitat and fish.
26	Do not use more than one application of imazapyr, metsulfuron methyl, or picloram on a given area in any two calendar years, except to treat areas missed during the initial application. Aminopyralid would not be broadcast in any area more than once per year. Avoid application of persistent herbicides on anaerobic soils or saturated duff layers within 100 feet of streams.	Reduce potential for herbicide accumulation in soil.
27	Limit herbicide offsite transport on sites with high runoff potential including sites with: · shallow seasonal water tables, · saturated soils (wet muck and peat soils), · steep erosive slopes with shallow soils and rock outcrop, or · bare compacted and disturbed soils. Limit runoff by applying herbicide: · during the dry season with the lowest soil moisture conditions · where > 50% groundcover exists on shallow slope sites and > 70% on steep slope sites, and/or · at reduced rates.	Reduce potential offsite runoff transport of herbicides.
28	Areas of gouging or soil displacement resulting from manual treatment methods (digging or pulling) within 35 feet of water courses with surface water present will be treated to prevent rill and gully erosion and possible sediment delivery to steam courses. Erosion control treatment will include scattering seed and mulch (straw) to create flow disruption and surface soil stability.	Minimize short- and long-term soil, hydrologic and water quality impacts.
29	Herbicide use buffers have been established for perennial and wet intermittent steams; dry streams; and lakes and wetlands. Buffers vary by herbicide ingredient and application method. Tank mixtures would apply the largest buffer as indicated for any of the herbicides in the mixture.	To reduce likelihood that herbicides would enter surface waters in concentrations of concern. Comply with R6 2005 ROD Standards 19 and 20.

MR/MM ID	Management Requirements and Mitigation Measures	Objective
30	Apply erosion control measures (e.g. silt fences or shut down periods) and native re-vegetation (e.g., mulching, native grass seeding, planting) for manual treatment where soil disturbance or de-vegetation may result in the delivery of measurable levels of fine sediment to federally listed fish species' critical habitat.	Minimize short- and long-term soil, hydrologic and water quality impacts.
	Wildlife	
31	Treatment of areas within 0.25 mile, or 0.5 mile line-of-site of bald eagle nests would be timed to occur outside the nesting season of January 1 – August 15 unless treatment activity is within ambient levels of noise and human presence (as determined by a local specialist). This seasonal restriction may be waived if a biologist determines by appropriate surveys that nest sites are not active that year.	To minimize disturbance to nesting bald eagles and protect eggs and nestlings
32	Noise-producing activity above ambient levels would not occur between October 31 and March 1 within 0.25 mile, or 0.50 mile line-of-sight, of known bald eagle winter roosts and concentrated foraging areas. Disturbance to daytime winter foraging areas would be avoided.	To minimize disturbance and reduce energy demands during stressful winter season.
33	Treatment of areas within 1.0 mile line-of-site of known grizzly bear dens would be timed to occur outside the denning season of October 30 – April 30.	To minimize disturbance and reduce energy demands to denning grizzly bear.
34	Treatment of areas within 1.0 mile line-of-site of known wolf dens would be timed to occur outside the denning season of April 1 – June 30.	To minimize disturbance and reduce energy demands to denning wolves.
35	Treatment of areas within 0.5 mile line-of-site of occupied rendezvous site would be timed to occur outside the season of April 1 – August 31, unless treatment activity is within acceptable ambient noise levels and human presence would not cause wolves to abandon the site (as determined by local specialist) .	To minimize disturbance and reduce energy demands to gray wolves.
36	Seasonal restrictions would apply during the periods listed below based on the following elevations within 0.5 miles of peregrine nest sites (primary nest zone): · Low elevation sites (1000-2000 ft.) 01 Jan - 01 July · Medium elevation sites (2001-4000 ft.) 15 Jan - 31 July · Upper elevation sites (4001+ ft.) 01 Feb - 15 Aug Seasonal restrictions would be waived within primary and secondary nest zones if the site is unoccupied or if nesting efforts fail and monitoring indicates no further nesting behavior. Seasonal restrictions would be extended if monitoring indicates late season nesting, asynchronous hatching leading to late fledging, or recycle behavior which indicates that late nesting and fledging would occur.	To reduce disturbance to nesting falcons and protect eggs and nestlings.
37	Invasive plant treatments involving motorized equipment and/or vehicles would be seasonally prohibited within 1.5 miles of known nest sites (secondary nest zones). This may include activities such as mulching, chainsaws, vehicles (with or without boom spray equipment) or other mechanically based invasive plant treatment. Non-mechanized or low disturbance invasive plant activities (such as spot spray, hand pull, etc.) may occur within the secondary nest zone, but would be coordinated with the wildlife biologist on a case-by-case basis to determine potential disturbance to nesting falcons and identify mitigating measures, if necessary. Seasonal restrictions would be waived within primary and secondary nest zones if the site is unoccupied or if nesting efforts fail and	To reduce disturbance to nesting falcons and protect eggs and nestlings.

MR/MM ID	Management Requirements and Mitigation Measures	Objective
	monitoring indicates no further nesting behavior. Seasonal restrictions would be extended if monitoring indicates late season nesting, asynchronous hatching leading to late fledging, or recycle behavior which indicates that late nesting and fledging would occur.	
38	Clopyralid would not be used within 1.5 miles of peregrine nest more than once per year. Picloram would not be used more than once every 2 years.	To reduce exposure to hexachlorobenzene (HCB).
39	Active nest sites should be protected from disturbance above ambient levels during the dates specified. Local biologist will determine appropriate distances for planned operations prior to implementation.	To minimize or eliminate disturbance to nesting raptors.
40	Avoid broadcast spraying of herbicide in talus or rocky outcrops, springs, seeps or stream margins to protect Van Dyke's and Larch Mountain salamanders. Utilize aquatic design features for suitable habitat in riparian areas, streams, and rivers.	To reduce likelihood of exposure to herbicides or additives from contaminated soil or water.
41	Avoid broadcast spraying of herbicide in known sites or high potential suitable mollusk habitat outside of roadside treatment locations when soil moisture is high (generally late fall to early spring).	To reduce likelihood of trampling and herbicide exposure.
42	Mower or motorized equipment use within 65 yards, of any nest site, activity center, or un-surveyed suitable habitat will be timed to occur outside the early nesting season of March 1 to July 15, if the project will last more than 1 day at a single location. Short duration projects using mowing or motorized equipment for less than 1 day or transient mowing equipment (such as road brushing) may occur in the early season. There is no seasonal restriction on the use of roadside broadcast sprayers.	To minimize disturbance to nesting spotted owls and protect eggs and nestlings.
43	Mower or motorized equipment use within 110 yards, of any known occupied site or un-surveyed suitable habitat will be timed to occur outside the nesting season of April 1 to September 23, if the project will last more than 1 day at a single location. Short duration projects using mowing or motorized equipment for less than 1 day or transient mowing equipment (such as road brushing) may occur in the early season. There is no seasonal restriction on the use of roadside broadcast sprayers.	To minimize disturbance to nesting marbled murrelets and protect eggs and nestlings
44	After April 1 and before September 24, activities generating noise above 92 dB may occur within the disturbance distances listed above, but must still be conducted between 2 hours after sunrise and 2 hours before sunset.	To minimize disturbance to marbled murrelets returning to nest tree during the breeding season.
	Recreation	
45	Administrative Sites**:** Notify Forest employees of upcoming herbicide treatment in advance through e-mail. At the site, post specific treatment methods, herbicide ingredients to be used, and precise treatment location 1 day prior to treatment. Posting to remain on site for 1 week following treatment.	To avoid exposing people to herbicides in administrative sites.
46	Recreation Residence Permit Holders: Notify permit holders of upcoming herbicide treatment in advance through the mail. At the entrance to the recreation residential area, post specific treatment methods, herbicide ingredients to be used, and precise location 1 day prior to treatment. Posting to remain on site for 1 week following treatment.	To avoid exposing recreation residence permit holders to herbicides.
47	Campgrounds: Provide information about upcoming herbicide treatment in advance through the campground reservation system. At	To avoid exposing campground users to

MR/MM ID	Management Requirements and Mitigation Measures	Objective
	the campground, post specific treatment methods, herbicide ingredients to be used, and precise location 1 day prior to treatment. Posting to remain on site for 1 week following treatment. To the extent possible, treat campgrounds early part of the work week.	herbicides
48	Trailheads, Picnic Areas and Viewpoints: Alert the public about upcoming herbicide treatments on the Forest website. At the picnic area, viewpoint or trailhead, post specific treatment methods, herbicide ingredients to be used, and precise location at the time of treatment. Posting to remain on site for 1 week following treatment.	To avoid exposing trailhead/picnic area/viewpoint users to herbicides.
49	Boat Launches not associated with picnic areas or campgrounds: Alert the public about upcoming herbicide treatments on the Forest website. At the boat launch, post specific treatment methods, herbicide ingredients to be used, and precise location at the time of treatment. Posting to remain on site for 1 week following treatment.	To avoid exposing boaters to herbicides.
50	Other treatment areas not listed (including wilderness): Alert the public about upcoming herbicide treatments on the Forest website. At logical locations (for instance, on roadside entry points to treatment areas) post specific treatment methods, herbicide ingredients to be used, and precise location at the time of treatment.	To avoid exposing Forest users to herbicides.
51	Do not apply triclopyr to edible target plants (berries) when fruit is present.	To avoid exposing Forest users to triclopyr.
	Heritage Resources	
52	If a heritage resource is discovered during implementation, or if an identified resource is affected in an unanticipated way, stop work and secure find; notify Forest Service Heritage Specialist and adhere to Programmatic Agreement (PA). Redesign the project to ensure that resources are avoided as determined by the Heritage Specialist, until the discovery is adequately considered pursuant to the PA.	Protect historic properties
53	If Indian human remains or specified cultural items are discovered, stop work, secure find. Make appropriate notification & adhere to regulatory process.	Protect American Indian burials and cultural items.
54	Tribal Government to Government notification will occur annually. EDRR notification will occur on a case by case basis.	Allow tribal members to provide input and/or be notified prior treatment.
55	Provide an information packet "Guide to Protecting Heritage Resources" to all personnel involved in the invasive plant treatment prior to project implementation. The packet will contain information on heritage resource identification (e.g. railroad grades, prehistoric artifacts, etc.) and instructions for any historic or prehistoric resources that may be found.	Protect historic properties
56	Ensure that a heritage specialist reviews treatment and restoration proposals for new invasive plant sites not identified in this EIS prior to implementation.	Protect historic properties
57	Provide Invasive Plant prescriber(s) with a list of invasive sites at which treatment / restoration may proceed; and a second list of invasive sites at which treatments may proceed, but require further consideration prior to hand planting restoration. All other treatment and or restoration sites not on these lists require a Heritage Specialist to determine if protection, survey, monitoring, or further mitigation is warranted.	Protect historic properties
58	If the treatment differs from the "first year/first choice" or the restoration differs from what has been analyzed, the heritage specialist will be contacted to review the changes and determine if additional survey, monitoring or mitigation is warranted.	Protect historic properties

Table 10. Herbicide Use Buffers

Herbicide	Perennial Streams and Wetlands, and Intermittent Streams and Roadside Ditches with flowing or standing water present			Dry Intermittent Streams and Wetlands		
	Broadcast Spraying	Spot Spraying	Hand Selective	Broadcast Spraying	Spot Spraying	Hand Selective
Labeled for Aquatic Use						
Aquatic Glyphosate	60	waterline	waterline	60	0	0
Aquatic Imazapyr	60	waterline	waterline	60	0	0
Aquatic triclopyr-TEA (acid)	Not Allowed	15	waterline	Not Allowed	0	0
Low Risk to Aquatic Organisms						
Aminopyralid	waterline	waterline	waterline	0	0	0
Imazapic	100	15	bankfull	60	0	0
Clopyralid	100	15	bankfull	60	0	0
Metsulfuron methyl	100	15	bankfull	60	0	0
Moderate Risk to Aquatic Organisms						
Imazapyr	100	50	bankfull	60	15	bankfull
Sulfometuron methyl	100	50	5	60	15	bankfull
Chlorsulfuron	100	50	bankfull	60	15	bankfull
Higher Risk to Aquatic Organisms						
Picloram	100	50	50	100	50	50
Glyphosate that is not labeled for aquatic use[16]	100	50	50	100	50	50
Triclopyr (BEE) (ester)	Not Allowed	50	50	Not Allowed	50	50

2.4.6 Early Detection Rapid Response

Early Detection/Rapid Response (EDRR) is aimed at treating new infestations that are small in size thus decreasing cost and the need for repeated herbicide applications. The existing "new invader" strategy would be modified to:

- Increase the treatment methods available for selection to be those included in the Record Decision for this EIS, along with all Management Requirements and Mitigation Measures.
- Facilitated treatment as soon as possible after detection.
- Add an annual herbicide application cap of 5,000 acres and an EDRR herbicide application cap at 13,500 acres.
- Add an implementation planning process.

Before treating new or existing sites, treatments would be prescribed based on the biology of the target species and size of the infestation. Relevant Management Requirements and Mitigation Measures

[16] The alternatives have been modified since the release of the DEIS; no POEA surfactant would be used in any alternative.

(MR/MM) and herbicide use buffers would be integrated into the implementation prescription based on site conditions. Pre-treatment surveys would occur as per the MR/MM.

Treatment would occur as soon as possible after finding new sites. This process would also apply to existing sites that have changed either because they have grown larger or because they have been reduced in size due to treatment. Coordination with adjacent landowners, water users, agencies, and partners would also occur prior to treatment. Government to government consultation with tribes would occur. Public notification would occur according to the MR/MM. Reporting items would be implemented as part of Section 7 ESA Consultation.

2.4.7 Implementation Planning Process

This section outlines the process that would be used to ensure that the selected alternative is properly implemented. The methodology follows integrated weed management principles (R6 2005 FEIS, 3-3) and satisfies pesticide use planning requirements at FSH 2109.14. It applies to currently known infestations and new sites found within or outside treatment analysis areas during ongoing inventory. Treatment prescriptions would be developed to ensure that MR/MM and herbicide use buffers are appropriately incorporated.

New detections and changes to known invasive plant sites are likely to be found during the course of implementing this project. Known sites could spread and become larger, or become smaller from effective treatment. Changes to site conditions over time would be considered in the context of Forest Service NEPA Handbook: FSH 1909.15 Chapter 18.1, which provides guidance on the “Review and Documentation of New Information Received After A Decision Has Been Made.” Treatments that are not specifically excluded (for instance: aerial spray, treatment of submerged or floating invasive plants, treatment of native plants) and that incorporate appropriate MR/MM, herbicide use buffers and treatment caps would be within the scope of the project and supplemental effects analysis would not be necessary.

1. Characterize invasive plant infestations to be treated

- Identify target species, location, density, and extent.
- Identify adjacent land uses and vectors for invasive plant spread
- Determine treatment objective and priority.

2. Develop site-specific prescriptions

- Identify effective integrated treatment method (Table 6).
- Determine whether herbicides are needed and which application method is needed based on the herbicide use decision criteria shown below.
- Apply appropriate MR/MM based on:
    - Past treatment history and response to past treatment
    - Proximity to species of local interest or their habitats
    - Proximity to streams, lakes, wetlands
    - Proximity to vectors and potential for persistent disturbance;
    - Surrounding National Forest land uses and activities
    - Soil conditions
    - Municipal watersheds and/or domestic water intakes
    - Recreation areas, special forest product and special use areas
    - First-choice or other effective herbicide

  - Application rate and method
- Once the treatment prescription has been refined:
  - Complete Form FS-2100-2 Pesticide Use Proposal. This form lists treatment objectives, specific herbicide(s) that would be used, the rate and method of application, and MR/MM that apply.
  - Determine need for pre-project surveys for species of local interest and/or their habitats.
  - Coordinate with adjacent landowners, water users, agencies, partners, and tribal governments.
  - Initiate public notification.
  - Obtain EPA National Pollution Discharge Elimination System (NPDES) permit for herbicide use on stream banks; on invasive plants that hang over streams; or treatments within 3-5 feet of live streams or other water bodies.

3. Accomplishment and Compliance Monitoring

- Develop a project work plan for herbicide use as per FSH 2109.14.3. This work plan presents organizational and operational details including the precise treatment objectives, equipment, materials, and supplies needed; the herbicide application method and rate; field crew organization and lines of responsibility; and interagency coordination.
- Ensure that contracts and agreements include the appropriate integrated prescriptions that are consistent with MR/MM and the herbicide use buffers.
- Document and report herbicide use and certified applicator information in the National pesticide use database, via the Forest Service Activity Tracking System (FACTS). The national pesticide use report extracts data from FACTS.

4. Post-treatment Monitoring and Recurring Treatments

- Monitoring would occur during implementation to ensure project MR/MM are implemented as planned. Post-treatment reviews would occur to determine whether treatments are effective and whether or not passive/active restoration is occurring as expected. Not all sites would be visited annually, but most would be visited at some time during or after treatment.
- Contract administration and other existing mechanisms would be used to correct deficiencies. Herbicide use would be reported as required by the FSH 2109.14 and FACTS.
- A sample of sites would be evaluated after treatment to determine whether MR/MM were appropriately applied, and whether non-target vegetation impacts were within tolerable levels.
- Prescriptions would be refined over time based on post-treatment results as long as treatments remain within the scope of the EIS. For instance, an invasive plant population treated with a broadcast herbicide may be retreated with a spot spray, or later manually pulled, once the size of the infestation is sufficiently reduced following the initial treatment. Another example would be the use of another herbicide if the first choice is not effective.
- Treatment buffers would be expanded if damage was found outside herbicide-use buffers as indicated by a decrease in the size of any non-target plant population, leaf discoloration or chlorophyll change, or mortality to individual species of local interest or non-target vegetation. The findings would be applied to herbicide-use buffers for water bodies. Herbicide-use buffers may be adjusted for certain herbicides/application methods and not others, depending on results.

See discussion about monitoring later in this chapter for additional information.

The Decision to Use Herbicides

The following series of questions to be answered apply to currently known infestations and new sites found within or outside treatment analysis areas during ongoing inventory. If the target species population is not associated with a size, phenology, density or distribution that warrants herbicide use (alone or in combination with other methods), or if herbicide use does not substantially increase treatment efficiency (considering the availability of volunteers if needed), then non-herbicide methods would be favored.

Herbicide Use Decision Criteria

1. Is the target population associated with a size, phenology, density or distribution that warrants herbicide use (alone or in combination with other methods)? Consider whether or not herbicides are required for treatment effectiveness and/or whether or not the use of herbicides substantially increases cost-effectiveness of treatment? Consider whether volunteers may be available to implement of manual treatments.

> *Yes* (potentially use herbicides): List potential herbicide choices and integrated prescription. Review label directions and project design criteria. Consider non-target vegetation surrounding treatment sites and use selective herbicides as appropriate. Consider soil conditions at the treatment site. Consider previous treatments that have occurred on the site. Were they effective? Would another herbicide or combination of methods be more effective? Also note that triclopyr may not be used in areas of known special forest product or subsistence collection. Go to 2.
>
> No: Use non-herbicide methods.

2. Do the size, density and/or distribution of invasive plants warrant the broadcast application method? Would another herbicide besides triclopyr be effective? (Please note that triclopyr may not be broadcast)

> *Yes*: Could the treatment site be within no broadcast buffers for effective herbicides? Is the site in a wildlife habitat that has specific restrictions to broadcasting? Is this site within a wilderness area? Go to 3a.
>
> No: Go to 3b.

3a. Apply surface water buffers as appropriate. Is this site within an area where broadcasting is prohibited?

> *Yes*: Do not broadcast. Go to 4.
>
> No: Go to 3b.

3b. Are there botanical species of local interest/suitable habitat near the proposed broadcast site?

> *Yes*: Survey as needed within suitable habitats. Apply botanical buffers as appropriate. Go to 4.
>
> No: Broadcasting is an acceptable treatment method for herbicides except triclopyr.

4. Will spot and/or selective methods be reasonably effective in this situation?

> *Yes*: Apply spot/selective buffers and use aquatic labeled herbicides as appropriate.
>
> No: Consider additional project planning for an effective treatment.

2.4.8 Monitoring

Monitoring for the Proposed Action includes assessment before, during and after implementation (see implementation planning process). Before implementation, a project work plan for herbicide use would be developed as described in FSH 2109.14.3. This plan presents organizational and operational details including treatment objectives, the equipment, materials, and supplies needed; the herbicide application method and rate; field crew organization and lines of responsibility, and a description of interagency coordination. The plan would also include a job hazard analysis to assure applicator safety. Before treatment, relevant MR/MM would be identified.

During implementation, a sample of treatment sites would be inspected to ensure that MR/MM were properly implemented. The MR/MM for soils, water and fish include Best Management Practices for water quality. These would be monitored using national protocols during (and after implementation). Deficiencies would be corrected immediately.

Herbicide use would be documented and reported in the National Pesticide Use Database, via the Forest Service Activity Tracking System (FACTS) and Natural Resource Information System (NRIS) databases annually. Applicator information would be tracked through the Washington Department of Agriculture Pesticide licensing database. Records would be maintained to track treatment extent within the annual and life of the project caps.

Post-treatment reviews would be conducted over time to determine whether treatments were effective and what additional treatments, including active restoration, are needed. Most sites would be revisited to determine whether treatment objectives have been met. The process described under EDRR above would be followed for re-treatment of existing sites. Treatment prescriptions would be adapted to site conditions that change over time.

A sample of sites would also be reviewed to determine whether damage to botanical species of conservation concern is occurring. MR/MM would be adjusted if unexpected impacts to botanical species of conservation concern are found. Additional monitoring may be done as part of the R6 2005 ROD Monitoring Framework or implementation of BMP monitoring protocols.

2.5 Alternative 3 – No Aminopyralid

2.5.1 Introduction

2.5.1.1 Alternative 3 at a glance

Treatment Methods	Manual, mechanical, cultural, chemical (herbicide) and biological. Restoration of treated sites.
Herbicides Approved	Herbicide formulations containing 1 or more of the following 9 active ingredients: chlorsulfuron, clopyralid, glyphosate, imazapic, imazapyr, metsulfuron methyl, picloram, sulfometuron methyl, and triclopyr. Of these, chlorsulfuron, metsulfuron methyl,[17] and triclopyr are first year, first choice herbicides that are not currently in use on the MBS.
Forest Plan Amendment	No.
Application Methods	Selective, spot, or broadcast treatments.
Treatment Acreage Limitations	Annually, treatment using herbicide would not exceed about 5,000 infested acres per year and no more than 13,500 acres of new infestations would be treated using herbicide over the life of the project (based on approximately 10 percent spread per year for 10 years). No more than 18% of the area within 150 feet of any flowing stream would be treated with herbicide annually (10 acres per 1.5 miles of stream).
EDRR Approach	Develop site prescriptions and address any resources of concern. Follow herbicide use decision criteria to determine preferred method. Integrate MR/MM into implementation prescription based on site conditions. Treat as soon as possible after finding new sites. Treatments would not be limited to those identified in a pre-season report.

Alternative 3 was developed in response to concerns about aminopyralid being a relatively newer herbicide with less of a history than the other herbicides proposed for use. Alternative 3 would be the same as Alternative 2 minus the use of aminopyralid (trade name: Milestone® or Milestone VM®). Alternative 3 would therefore not amend the MBS Forest Plan.

2.5.2 Integrated Treatment Prescriptions

Under this alternative, slightly fewer acres would be proposed for broadcast treatment than under the Proposed Action. Table 11 shows the first choice and other effective herbicides and integrated treatment methods that would be used for target species found on the MBS under Alternative 3. More clopyralid, metsulfuron methyl and triclopyr would likely be used in comparison to Alternative 2.

2.5.3 Post-Treatment Restoration

Post-treatment restoration would be the same as for Alternative 2.

2.5.4 Management Requirements and Mitigation Measures (MR/MM)

All of the Management Requirements/Mitigation Measures (MR/MM) and other components of Alternative 2 would also apply to Alternative 3, except for MR/MM and herbicide use buffers that apply to aminopyralid. Project caps would be the same as for Alternative 2.

[17] With the exception of Skiyou Island where metsulfuron methyl is currently approved (2008 Skiyou Island Invasive Weed Treatment DN)

2.5.5 Early Detection and Rapid Response

The Early Detection and Rapid Response process would be the same as for Alternative 2.

2.5.6 Implementation Planning Process

The Implementation Planning Process would be the same as for Alternative 2.

2.5.7 Monitoring

All of the monitoring that applies to Alternative 2 would be incorporated into Alternative 3.

Table 11. Integrated Treatment Prescriptions – Alternative 3 (No Aminopyralid)

Target species (Common Name)	Approximate Number of Sites	Approximate Acreage Infested[1]	First Choice Herbicide (those NOT available in current program are bolded)	Other Possible Herbicides (those NOT available in current program are bolded)	Effective Non-Herbicide Treatments (alone or in combination with herbicide use)
Absinth wormwood	1	2.2	Clopyralid	Glyphosate	Non-herbicide treatments are not effective.
Birds-foot trefoil	2	22	Clopyralid	**Triclopyr** Glyphosate	Manual digging. Removing flowering plants, non-flowering can be left on site to dry.
Bittersweet nightshade	1	<1	Glyphosate	Imazapyr **Triclopyr** **Imazapic**	Manual digging. All plant parts should be removed from site.
Black locust	1	<1	**Triclopyr**	Glyphosate	Hand cutting
Bull thistle	107	63	Clopyralid	Glyphosate **Triclopyr**	Effective biological control agents. Manual pulling and digging. Leave roots on site to dry, bag seed heads if present
Butterfly bush	15	22	Glyphosate	**Triclopyr** Imazapyr	Effective biological control agents. Manual pulling, digging and cutting. Rhizomatous, suckering plants, remove all plant parts from site.
Canada thistle	159	404	Clopyralid	**Picloram** Glyphosate **Chlorsulfuron**	Effective biological control agents.
Common burdock	2	<1	**Triclopyr**	Clopyralid Glyphosate	Manual pulling and digging. Seeds to be removed from site, all other plant parts can remain on site.
Common comfrey	3	<1	Glyphosate	Clopyralid	Non-herbicide treatments are not effective.
Common groundsel	4	<1	Clopyralid	Glyphosate	Manual pulling and digging Non-flowering plants can be left on site, remove plants that are in bud/flowering stage.
Common periwinkle	4	<1	Glyphosate	**Triclopyr** **Picloram**	Manual pulling, raking and digging. Can be left on site to dry.

Target species (Common Name)	Approximate Number of Sites	Approximate Acreage Infested[1]	First Choice Herbicide (those NOT available in current program are bolded)	Other Possible Herbicides (those NOT available in current program are bolded)	Effective Non-Herbicide Treatments (alone or in combination with herbicide use)
Common tansy	19	73	**Metsulfuron methyl** (Approved Currently At Skiyou Island)	**Chlorsulfuron** Glyphosate	Manual digging. Remove all flower/seed heads from site, all other plant parts can be left at site.
Common teasel	1	<1	**Triclopyr** Clopyralid	Glyphosate **Metsulfuron methyl** **Chlorsulfuron**	Non-herbicide treatments are not effective.
Cutleaf blackberry	12	32	**Triclopyr**	Glyphosate	Manual pulling and digging. All plant parts can be left on site to dry.
Dalmatian toadflax	8	24	**Chlorsulfuron**	**Picloram** **Imazapic** **Metsulfuron methyl** Glyphosate	Effective biological control agents. Manual pulling and digging. All parts except seeds can be left on site.
Diffuse knapweed	3	41	Clopyralid	**Triclopyr** Glyphosate **Picloram**	Effective biological control agents. Manual pulling and digging. All plant parts except flower/seed heads can remain on site.
Elephant ear/Japanese sweet coltsfoot	2	<1	Glyphosate	Glyphosate	Manual digging. Plant parts can be left on site to dry.
English holly	4	<1	Glyphosate	Glyphosate	Manual pulling and digging. Mechanical cutting. Plants can be left on site to dry.
English ivy	3	<1	**Triclopyr**	Glyphosate	Manual pulling and digging. Seeds if present, to be removed, all other plant parts can be left on site to dry
European lily of the valley	1	<1	Glyphosate	**Metsulfuron methyl** **Chlorsulfuron**	Manual digging. Remove all plant parts from site.
Field bindweed	4	<1	Glyphosate	**Triclopyr** **Picloram**	Effective biological control agents.
Giant hogweed	1	<1	Glyphosate	**Triclopyr**	Manual pulling and digging. Plant can be left on site, but should be removed in areas where the public may encounter the plant.

Target species (Common Name)	**Approximate Number of Sites**	**Approximate Acreage Infested[1]**	**First Choice Herbicide (those NOT available in current program are bolded)**	**Other Possible Herbicides (those NOT available in current program are bolded)**	**Effective Non-Herbicide Treatments (alone or in combination with herbicide use)**
Hairy cat's ear	2	159	Clopyralid	Glyphosate **Picloram**	Manual digging. Competitive seeding. All but flower/seed heads can be left on site.
Hawkweed – Non-native (common, orange, yellow, spotted, smooth, tall)	140	1,233	Clopyralid	**Triclopyr** Glyphosate	Effective biological control agents. Manual pulling and digging. All plant parts should be removed from site.
Hedge false bindweed	4	<1	Glyphosate	**Triclopyr** **Picloram**	Non-herbicide treatments are not effective.
Herb Robert	126	850	Glyphosate	Glyphosate	Manual pulling and digging. Plants not in flower can be left on site, all others removed.
Himalayan blackberry	14	55	**Triclopyr**	Glyphosate	Manual pulling and digging. All plant parts can be left on site to dry.
Jewelweed	1	3	Glyphosate	**Triclopyr** **Metsulfuron methyl**	Manual pulling. Plants in flower should be removed.
Knotweed (Bohemian, giant, Japanese)	74	892	Glyphosate Imazapyr	Glyphosate Imazapyr	Non-herbicide treatments are not effective.
Meadow knapweed	3	11	Clopyralid	**Triclopyr** Glyphosate **Picloram**	Effective biological control agents. Manual digging. All plant parts except flower/seed heads can remain on site.
Oxeye daisy	3	156	Clopyralid	**Picloram** Glyphosate	Manual pulling and digging. All plant parts except flowers can be left on site.
Poison hemlock	1	<1	Glyphosate	**Metsulfuron methyl** **Triclopyr**	Manual pulling and digging. Plant parts except seeds can be left on site.
Policeman's helmet	1	<1	Glyphosate	**Triclopyr** **Metsulfuron methyl**	Manual pulling and digging. Remove flower heads/seed from site.
Reed canary grass	3	121	Glyphosate	**Sulfometuron methyl** Imazapyr	Approved non-herbicide methods are not effective.
Rhubarb	1	<1	Glyphosate	Imazapyr Clopyralid	Manual digging. Plant can be left on site to dry.

Target species (Common Name)	**Approximate Number of Sites**	**Approximate Acreage Infested**[1]	**First Choice Herbicide (those NOT available in current program are bolded)**	**Other Possible Herbicides (those NOT available in current program are bolded)**	**Effective Non-Herbicide Treatments (alone or in combination with herbicide use)**
Scotch broom	73	141	**Triclopyr**	Glyphosate	Effective biological control agents. Manual pulling and digging and mechanical cutting. All plants parts except those with seed pods can be left on site.
Spotted knapweed	32	173	Clopyralid	**Picloram** Glyphosate **Triclopyr**	Effective biological control agents. Manual pulling and digging. All plant parts except flower/seed heads can remain on site.
St. Johnswort	1	2	**Metsulfuron methyl**	**Picloram** Glyphosate	Effective biological control agents. Manual pulling and digging. Remove all plant parts from site.
Sulphur cinquefoil	12	75	**Metsulfuron methyl**	**Picloram** Glyphosate **Triclopyr**	Manual pulling and digging. All plant parts except seeds can be left on site.
Tansy ragwort	75	319	**Metsulfuron methyl** **(**Approved Currently At Skiyou Island)	**Picloram** Clopyralid Glyphosate **Triclopyr**	Effective biological control agents. Manual pulling and digging. All flowering parts, including those not yet in bloom, removed from site.
Wild carrot	4	2	**Metsulfuron methyl**	**Chlorsulfuron** **Triclopyr** Glyphosate	Manual pulling. Remove flower/seeds from site.
Woolly hedgenettle	1	<1	Glyphosate	**Triclopyr** Imazapyr	Manual pulling and digging. Remove all plant parts from site.
Yellow archangel	6	<1	Glyphosate	**Triclopyr** Imazapyr **Metsulfuron methyl**	Manual pulling and digging. Remove all plant parts from site.
Yellow flag iris	1	<1	Imazapyr	Glyphosate	Manual pulling and digging. Remove rhizomes and seeds from site.
Estimated Total[1]	935	4,878			

[1]Infested acreage is imprecise and likely to far overestimate the extent of inventoried target species. Some of the target species co-occur within infested acres.

Table 12. Total Acres by First Year/First Choice Treatment for Alternative 3

First Year/First Choice Treatment	Total Acres	Comparison to Alternative 2
biocontrol	80	Same as Alternative 2
manual	101	Same as Alternative 2
aminopyralid	0	2,368 fewer acres than Alternative 2
clopyralid	2,202	2,122 more acres than Alternative 2
chlorsulfuron	24	Same as Alternative 2
glyphosate	1,068	Same as Alternative 2
glyphosate/imazapyr mix	892	Same as Alternative 2
metsulfuron methyl	368	168 more acres than Alternative 2
triclopyr	143	128 more acres than Alternative 2

About 2,407 infested acres are of a density or size large enough to warrant broadcast application. This acreage does not consider the influence of MR/MM and herbicide use buffers that prohibit broadcasting of certain herbicides near streams and other sensitive areas (such as roads having higher risk of herbicide delivery to fish bearing streams). Table 13 shows the first year/first choice acreage likely to require broadcast application.

Table 13. Herbicide active ingredient and estimated broadcast acres for Alternative 3

Herbicide Active Ingredient Target species	Alternative 3 Estimated Broadcast Acres
Clopyralid	
Canada thistle	293.7
common hawkweed	599.9
diffuse knapweed	9.9
hairy cat's ear	158.4
meadow hawkweed	143.4
orange hawkweed	159.0
oxeye daisy	155.2
smooth hawkweed	62.5
spotted hawkweed	31.5
spotted knapweed	46.7
yellow hawkweed	138.6
Total Acres Broadcast Clopyralid	***1,798***
Glyphosate	
cutleaf blackberry	24.9
herb Robert	167.3
Himalayan blackberry	46.1
reed canarygrass	120.3
Total Acres Broadcast Glyphosate	***358.6***
Metsulfuron Methyl	
common tansy	67.5
St Johnswort	1.6

Herbicide Active Ingredient Target species	Alternative 3 Estimated Broadcast Acres
sulphur cinquefoil	73.7
tansy ragwort	107.4
Total Acres Broadcast Metsulfuron Methyl	***250.2***
Total Estimated Acres-Broadcast	***2,406.8***

2.6 Alternatives Not Considered in Detail

Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14(a)). Several alternatives were suggested during the public scoping process and were examined by the Interdisciplinary Team. Five alternatives were considered but not evaluated in detail.

2.6.1 Hand Treatments Only, Using a Large Workforce (paid or volunteer)

This alternative would have required that invasive plant be treated using only hand tools (manual). A large work force (paid or volunteer) would have been required. All alternatives, including No Action, could authorize volunteers or paid crews to pull invasive plants and accomplish other treatments by hand. However, several target species would not be effectively contained, controlled or eradicated using hand tools and the cost of managing and implementing such an alternative (even with volunteers) would be prohibitive.

2.6.2 Use of Alternative Products

An alternative was suggested that the Forest Service should use vinegar and dish soap, clove oil or other homemade or commercial "non-toxic" substances in lieu of herbicides to treat invasive plants. Herbicide/additive use is limited to products with Forest Service risk assessments. These products suggested have not been assessed and the amount that would need to be used would likely have serious environmental consequences (for instance, vinegar could adversely affect soil pH). Steam application was also suggested. The equipment for steam application is very expensive and is not widely available.

2.6.3 Avoid Use of Certain Herbicides Approved in the R6 2005 ROD

An alternative that avoided using specific herbicides approved in the R6 2005 ROD was considered but not developed for detailed study. Some of these herbicides (glyphosate, clopyralid, imazapyr and metsulfuron methyl) are already in use on the MBS. The Forest Service has assessed the risks of using these herbicides and the R6 Regional Forester decided to approve their use. Limitations on herbicide choices would tend to reduce the potential cost-effectiveness of the treatment project. The first year/first choice herbicides were selected for their relatively high effectiveness and relatively low risk. Having other effective herbicides available increases the likelihood of treatment effectiveness over time. This alternative was not carried forward for full analysis because it would not meet the purpose of the project to treat invasive plants in the most cost-effective manner possible, while meeting Forest Plan standards that minimize risk. The risks from herbicide use would be minimized by Management Requirements and Mitigation Measures, herbicide use buffers, and project caps.

2.6.4 No Broadcasting

An alternative that would have required spot or selective herbicide application (no broadcasting) was considered but not developed for detailed study. Preliminary analysis for this alternative was conducted and the IDT found that the herbicide use buffers and Management Requirements and Mitigation Measures effectively minimized the risks of broadcasting. Thus, this alternative would have reduced effectiveness without providing any additional resource protection so it was not developed for detailed study.

An alternative was suggested that eliminated broadcasting within wilderness areas. Broadcast spraying is not proposed within wilderness areas in any alternative.

2.6.5 Integrate Prevention into Alternatives

An alternative that integrated invasive plant prevention measures into land uses was considered but not developed for detailed study. Prevention is already part of the MBS invasive plant management program and measures for preventing invasive plants are already integrated into land use activities. The purpose and need for this project is limited to meeting treatment objectives on existing and newly detected invasive plants found on the MBS. Prevention is routine on the MBS and would occur regardless of alternative in this EIS, including No Action (Alternative 1).

2.6.6 Goat Grazing

During the comment period to the DEIS, one comment letter mentioned that use of goats to eat invasive plants should be considered. Goats can be an effective means of reducing biomass associated with invasive plants. Goats must remain on a site for a long period and a goat herder must remain on site full time to ensure safety and environmental protection (Briana Murphy presentation at the Oregon Vegetation Management Association 2014 Conference). Grazing to manage weeds on roadsides, trailheads, and larger infestations on the forest is limited because of the difficulty of maintaining and managing the animals. Invasive plants can compensate quickly after the grazing pressure is removed because their seeds are long-lived in the soil, and because they can rapidly increase flower stem production once grazing pressure is removed (R6 2005 FEIS page 3-84).

The Forest Service could consider using goats as an invasive plant treatment method in the future if an appropriate site is identified. This alternative was not developed for detailed study in this EIS because no sites appropriate for grazing have been identified and thus, no site-specific effects analysis could be conducted.

2.7 Alternatives Compared

This section summarizes and compares the alternatives by the activities proposed, and how each responds to the issues and the related effects on the issue indicators, based on the analysis in Chapter 3. Table 14 compares the components of each alternative. Table 15 compares Management Requirements and Mitigation Measures currently in use under No Action to those that would be included in the action alternatives. Table 16 compares the existing and proposed new invader/EDRR strategy. Table 17 compares the alternatives in terms of their response to the issues listed in Chapter 1 and analyzed in Chapter 3.

Table 14. Comparison of Alternative Components

Alternative Component	No Action (Alternative 1)	Proposed Action (Alternative 2)	No Aminopyralid (Alternative 3)
Treatment Methods	Manual, biological, cultural and chemical (herbicide). Restoration of treated sites.	Same as Alternative 1, with the addition of mechanical methods (mowing/string trimming).	Same as Alternative 1, with the addition of mechanical methods (mowing/string trimming).
Herbicides Approved	Clopyralid Aquatic glyphosate Aquatic imazapyr Metsulfuron methyl (Skiyou Island only)	Aminopyralid Chlorsulfuron Clopyralid Glyphosate Imazapic Imazapyr Metsulfuron methyl Picloram Sulfometuron methyl Triclopyr	Chlorsulfuron Clopyralid Glyphosate Imazapic Imazapyr Metsulfuron methyl Picloram Sulfometuron methyl Triclopyr
Risk From Invasive Plants	Invasive plants may continue to threaten native plant communities, wildlife habitats and riparian areas.	Most likely to reduce threats from invasive plants	Less likely to reduce threats from invasive plants because aminopyralid would not be approved for use.
Forest Plan Amendment	No	Yes	No
Application Methods	Selective and spot (broadcast at Skiyou Island only)	Selective, spot, broadcast	Selective, spot, broadcast
Potential Broadcast Acres (Known Sites, First Year Treatment)	About 212 at Skiyou Island using glyphosate and metsulfuron methyl	2,470 using aminopyralid, clopyralid, glyphosate and metsulfuron methyl	2,407 using clopyralid, glyphosate and metsulfuron methyl
Herbicide Application Acreage Limitations	None	5,000 per year, 13,500 new acres detected under EDRR, 18% of the area within 150 feet of a stream annually	Same as Alternative 2
EDRR Approach	Annual pre-season list for treatment of new invaders. Treatments may only occur on 1) high priority sites and 2) only after soliciting comments from interested parties, agencies and tribes.	Develop site prescriptions and address any resources of concern. Follow herbicide use decision criteria to determine preferred method. Integrate MR/MM (including coordination and notification requirements) into implementation prescription. Treat as soon as possible after finding new sites. Treatments would not be limited to those identified in a pre-season report. Consult and report as agreed through tribal consultation and ESA Section 7 consultation.	Same as Alternative 2

Table 15. Comparison of the Management Requirements and Mitigation Measures currently approved under the no action and action alternatives

No Action (2005 EA)	Action Alternatives
General	
1. In treating any/all infestations, all applicable management requirements and practices, included in the Forest Plan Prevention Strategy, Best Management Practices (BMPs) for invasive plants will be followed.	Forest-wide prevention measures (BMPs) have been developed and would be followed regardless of alternative selected.
2. In particular, after working in invasive plant sites, all tools, equipment, and gear must be cleaned (power wash or high pressure spraying) before leaving the area, in order to avoid spreading the infestation further (Forest Plan, BMPs).	This measure is included in the action alternatives.
3. All invasive species management must be coordinated with all other site or area resources objectives.	This measure is replaced by specific coordination requirements in the MR/MM for the action alternatives.
4. Biocontrol treatments will use only those control agents that have been approved by the U.S. Department of Agriculture Animal and Health Inspection Service and permitted by the State of Washington.	This measure is Standard 14 from the R6 2005 ROD and would be followed regardless of alternative selected.
5. Any mulch used must be approved as invasive plant free, meeting the Forest Plan, Forest-wide Standards and Guidelines, Prevention Strategy and BMPs.	This measure is Standard 3 from the R6 2005 ROD and would be followed regardless of alternative selected.
General Herbicide Use	
6. No broadcast spraying (aerial or boom) will occur.	The 2008 Skiyou Island DN approved broadcasting for that one area. Both action alternatives would approve additional broadcasting where needed, according to MR/MM and herbicide use buffers.
7. Any preparation, transport, or application of herbicide will be done by trained workers with a current Washington State pesticide applicators license.	All alternatives follow the R6 2005 ROD Standard 15 that requires that people who apply herbicides be licensed or directly supervised by a licensed applicator.
8. Only the aquatic formulation of glyphosate will be used, and at the lowest effective rate as per manufacturer label specifications, which is estimated to be 2 ½ to 5 percent solution of the aquatic formulation of glyphosate diluted in water (3 ounces manufacturer's concentrate per gallon of water). Refer to Mitigation Measure #19, below, for application via stem injection.	This measure is not carried forward into the action alternatives. The lowest effective rate would be used based on the label and invasive plant being treated. Maximum rates for foliar application for the herbicides proposed in Alternative 2 are shown in Table 20 in chapter 3.1. Alternative 3 would use the same rates (but does not include aminopyralid).
9. If needed, the only surfactant that will be used is Agri-Dex®.	This measure is not carried forward into action alternatives. Action alternatives would allow for surfactant use that follows R6 2005 ROD Standard 18. See Appendix E for more information on surfactant. No NPE-based or POEA surfactants would be used. For herbicide applications within 100 feet of streams and other water bodies, surfactants approved by the Dept. of Ecology for use in aquatic environments would be required.
10. Pretreatment briefings will be conducted with all herbicide applicators to emphasize safety requirements, clarify treatment objectives and all mitigation measures, and to clarify identification of both target and non-target species.	This measure is specifically included in the action alternatives.

No Action (2005 EA)	Action Alternatives
Herbicide and Surfactant Transport, Mixing, Use	
11. Materials Safety Data Sheets, and Forest Service Information covering glyphosate and Agri-Dex® must be carried in each vehicle at all treatment times, and made available to interested members of the public, on-site.	These measures have been replaced with the following Herbicide Transportation and Handling Safety/Spill Prevention and Containment measures in the action alternatives. ü An Herbicide Transportation and Handling Safety/Spill Response Plan would be the responsibility of the herbicide applicator. At a minimum the plan would: ü Address spill prevention and containment. ü Estimate and limit the daily quantity of herbicides to be transported to treatment sites. ü Require that impervious material be placed beneath mixing areas in such a manner as to contain small spills associated with mixing/refilling. ü Require a spill cleanup kit be readily available for herbicide transportation, storage and application (minimum FOSS Spill Tote Universal or equivalent). ü Outline reporting procedures, including reporting spills to the appropriate regulatory agency. ü Ensure applicators are trained in safe handling and transportation procedures and spill cleanup. ü Require that equipment used in herbicide storage, transportation and handling are maintained in a leak proof condition. ü Address transportation routes so that traffic, domestic water sources, and blind curves are avoided to the extent possible. ü Specify conditions under which guide vehicles would be required. ü Ensure safe disposal of herbicide containers. ü Identify sites that may only be reached by water travel and limit the amount of herbicide that may be transported by watercraft. ü Workers will carry only enough herbicide daily to cover the proposed treatment for that day.
12. Glyphosate and Agri-Dex® containers must be secured and prevented from tipping during transport.	
13. Workers will carry only enough herbicide daily to cover the proposed treatment for that day.	
14. Mix only the amount of solution needed to complete daily treatments.	
15. Workers will follow all herbicide label guidelines.	
16. Containment mats will be used during mixing, to further avoid the risk of a spill.	
17. Do not mix glyphosate or glyphosate with Agri-Dex® within 300 feet of riparian areas, wetlands, or surface water.	
18. When glyphosate (with Agri-Dex®) is administered via wand-backpack spray, hand wiped, or painted on cut stems, the applicator will use the lowest effective rate.	All alternatives would require use of the lowest effective rate of any herbicide used in a given situation. Maximum application rates per acre for the 10 herbicides proposed in Alternative 2 are shown in Table 20.
20. Stem injection method would only be used on very small, high-priority infestations with difficult access.	This measure is not carried forward into the action alternatives. However, stem injection could be used where cost-effective.
21. No applications using wand-backpack spray will occur when wind speed exceeds five miles per hour, to lessen drift, or when precipitation is expected within 24 hours.	This measure is part of the action alternatives for broadcast herbicide application methods. Drift is not anticipated for spot applications. No herbicide applications would occur if there is a greater than 80 percent change of precipitation within 24 hours.
22. No hand wiping of leaves with the aquatic formulation of glyphosate with Agri-Dex® will be done when precipitation is expected within 24 hours.	No herbicide applications would occur if there is a greater than 80 percent change of precipitation within 24 hours.

No Action (2005 EA)	Action Alternatives
23. Application will occur only outside of timing constraints for wildlife, and when the chance of rain after application is very low.	This measure has been replaced by specific wildlife MR/MM in the action alternatives.
24. Herbicide mixture (aquatic formulation of glyphosate with or without Agri-Dex®) will be colored with a bright, non-toxic vegetable dye before application. This will (a) minimize the possibility of accidentally applying herbicide to non-target species; (b) minimize the amount of herbicide used, by avoiding re-application to plants that have already been treated; and (c) assist anyone who might be gathering forest products or near a treatment area (public or Tribe) in identifying plants and areas that should be temporarily avoided.	In the action alternatives, herbicide mixtures will be colored with a bright, non-toxic vegetable dye before application.
Soils/Water/Fisheries	
25. Soil disturbance (from hand digging, grubbing, pulling, etc.) will be minimized to the extent possible. Restoration of treated areas will follow the restoration treatment proposed for each site.	This measure is not part of the action alternatives; however restoration is part of the action alternatives (see Chapter 2.4.4). Mitigation for soil disturbance near streams is included.
26. As noted above [measure 17], all herbicide spray mixtures (aquatic formulation of glyphosate with or without Agri-Dex®) would not be prepared within 300 feet of riparian areas, wetlands, or surface water.	For the action alternatives, no herbicide mixing would occur within 300 feet of streams.
27. Containment mats will be used during mixing to further avoid the risk of a spill.	For the action alternatives, an impervious material would be placed beneath mixing areas in such a manner as to contain small spills associated with mixing/refilling.
28. Any mulch used must be approved as invasive plant free, meeting the Forest Plan, Forest-wide Standards and Guidelines, Prevention Strategy and BMPs.	This measure is included in the action alternatives as per R6 2005 ROD standard 3.
Wildlife	
29. From January 1 through August 15, restrict all treatment activity in known or suspected bald eagle nest territories.	These measures have been replaced in their entirety in the action alternatives.
30. Baker River Inlet to Baker Lake, Site 106: from November 1 through March 31, restrict all treatment activity near known, occupied eagle roost sites or key eagle foraging areas.	
31. From March 1 through July 15, restrict activities generating noise above ambient levels within 35 yards of suitable spotted owl nesting habitat.	
32. From April 1 through August 5, restrict activities generating noise above ambient levels within 35 yards of suitable marbled murrelet nesting habitat.	
33. For infestation treatments located within or adjacent to suitable nesting habitat for murrelets, leaving of any garbage or trash in the area is prohibited.	
Vegetation, Plants	
34. MBS Botanists will consistently provide training to contractors, state-wide, to educate them on accurate identification of invasive plants, so that only target species are treated and other desirable species are left unharmed.	These measures have been replaced in their entirety in the action alternatives.

No Action (2005 EA)	Action Alternatives
35. If any previously undiscovered rare plants are found within the project area, work will be halted until the USFS botanist is consulted and necessary mitigation measures are enacted.	
Heritage Resources	
36. An information packet will be provided to all personnel involved in the invasive plant treatment prior to project implementation. The packet will contain information on heritage resource identification (such as railroad grades, how to identify prehistoric artifacts, etc.) and instructions for any historic or prehistoric resources that may be found.	These measures have been replaced in their entirety in the action alternatives.
37. If a previously unidentified resource is discovered during project implementation—under any treatment method—or if at any time a resource that may be eligible for the National Historic	
Register of Historic Places is affected, in an un-anticipated way, reasonable steps will be taken to avoid or minimize harm to the resource until the Forest Service can fulfill its consultation requirements in accordance with the Programmatic Agreement for Heritage Resources (1997; see project files).	
Recreation, Public Use	
38. For any site with where recreation use/activity is high and invasive plant infestations are located other than along the peripheral (such as edges of parking lots, along road shoulders, etcetera), any treatment using the aquatic formulation of glyphosate (with or without Agri-Dex®) will occur only during the week, and not on weekends or 3-day holiday weekends. Sites will be signed and flagged, as noted above.	These measures have been replaced in their entirety in the action alternatives.
39. The only two examples among the 91 specific sites proposed for treatment are Gold Creek Pond (polygon # 48) and Buck Creek Camp (polygon # 148). While Buck Creek Camp is not operating for the 2005 season (camp is for sale), any treatment using the aquatic formulation of glyphosate (with or without Agri-Dex®) will be contingent upon scheduling with the Camp management, and/or the care-taker.	
Worker and Public Health and Safety	
40. All workers will comply with Occupational Health and Safety Administration (OSHA) standards, Forest Service Health and Safety Code Handbook, and other guidelines, BMPs, and manufacturers' recommendations to reduce the risk of injury to workers.	This measure is required as a matter of Forest Service policy and would be followed regardless of alternative selected.

Table 16. New Invader (EDRR) Approach

No Action	Action Alternatives
Based on the previous year's surveys, new invasive plant infestations would be documented [using the forms in Appendix D of the 2005 EA].	Invasive plant sites and treatment plans would be mapped according to Forest Service policy. Data bases such as NRIS and FACTS are used to track invasive plant populations and treatments.
New infestation sites would be prioritized.	No change. Priority would be determined in cooperation with implementation partners.
The current "set" of high-priority sites would be included in each year's prioritization, which could result in a newly-discovered site being ranked as a higher priority for treatment.	New and known sites would be treated according to priority, with some exceptions, for instance, if a medium or lower-priority infestation can be treated as part of another planned project, or as part of a suite of restoration projects within a watershed.
Once a new site is ranked as a high priority, an initial proposed treatment and restoration plan would be selected, based on the type of invasive plant, size of infestation, and location. Tools to make this assessment would include, but not be limited to: the biology of each invasive plant species and their control history [Appendix C of the 2005 MBS EA]; and MBS specific experience with treating invasive species [Appendix B, of the 2005 MBS EA]. The only treatment methods available for selection would be those included in the [2005 MBS] EA, along with all Management Requirements and Mitigation Measures.	The implementation planning process includes developing integrated treatment prescriptions according to MR/MM based on a comprehensive list of site considerations. This project does not include herbicide application directly to water, aerial application of herbicides, use of any pesticides other than herbicides, treatment of aquatic invasive plants (floating and submerged), treatment of native plants, and changes in land uses to slow or prevent the spread of invasive plants. Otherwise, treatments according to all of the design features (MR/MM, herbicide use buffers, treatment caps), would be considered in the scope of the action alternatives.
A new annual newsletter would be produced each spring, listing the new sites. It would be mailed to all interested parties, including agencies (such as U.S. Fish and Wildlife Service (USFWS), and NOAA Fisheries), Tribes, and others. Comments would be solicited.	No annual newsletter required. Notification would occur as per the MR/MM. Consultation with tribes and ESA regulatory agencies would occur as agreed.
For each new, high-priority site: the effects on other resources from treatment/restoration would be estimated. This information would be included in the newsletter.	No additional effects analysis is required for treatments within the scope of the action alternatives. Treatments according to all of the design features (MR/MM, herbicide use buffers, treatment caps), would be considered in the scope of the action alternatives.
If the effects are found to be within the scope of this EA, and USFWS and NOAA Fisheries concur through informal Section 7 (ESA) consultation, sites would be added as addenda.	Report as agreed as a result of Section 7 Consultation.
All treatments would be accomplished as funding is available.	No change.

Table 17. Comparison of the alternatives based on issue indicators

Issue and Indicator	Alternative 1	Alternative 2	Alternative 3
Cost-Effectiveness: Estimated Total Cost in Dollars for Treating Known Sites Known Sites Treatment Plus Restoration	2,719,000	2,535,600	2,630,400
Cost-Effectiveness: Estimated Average Cost Per Treated/Restored Acre in Dollars	557	520	539
Cost-Effectiveness: Years to Effectively Treat Known Sites Assuming Annual Budget of $200,000 per year	14	12-13	13
Cost-Effectiveness: Estimated Maximum Cost in Dollars, Assuming Average Cost Treatment Plus Restoration applied to known sites plus 13,500 acres of new detections	NA	9.5 million	10 million
Cost-Effectiveness: Estimated acres where ability to control or eradicate target species may be compromised due to broadcasting restrictions	1,200	0	274
Herbicide Toxicity/Human Health: Number and character of “plausible exposure scenarios” where “Hazard Quotient” may be greater than 1 for herbicide applicators (workers)	none	Triclopyr HQ = 1.5 for a worker wearing contaminated gloves (15 “first year/first choice” acres)	Triclopyr HQ = 1.5 for a worker wearing contaminated gloves (143 “first year/first choice” acres)
Herbicide Toxicity/Human Health: Number and character of “plausible exposure scenarios” where “Hazard Quotient” may be greater than 1 for the public	none	Triclopyr HQ = 7.8 for consumption of contaminated vegetation (15 “first year/first choice” acres)	Triclopyr HQ = 7.8 for consumption of contaminated vegetation (143 “first year/first choice” acres)
Herbicide Toxicity/Human Health: Character and effectiveness of Management Requirements and Mitigation Measures (MR/MM) intended to minimize or eliminate risk to human health	MR/MM minimize risks; herbicide ingredients pose low risks to human health	MR/MM minimize risks; risk is greater than Alternative 1 due to inclusion of triclopyr, less than Alternative 3 due to inclusion of aminopyralid.	MR/MM minimize risks; risk is greater than Alternative 1 due to inclusion of triclopyr.
Herbicide Toxicity/Botany: Relative risk to botanical species of conservation concern from herbicide use	Very Low, no broadcast near rare plants. Non-selective herbicide use may be needed near water (glyphosate).	Very Low; broadcast treatments are proposed in 7 TAAs where botanical species of conservation concern are located, however MR/MM would minimize risk. Use of aminopyralid is likely to decrease risk compared to non-selective herbicide use.	Low; broadcast treatments are proposed in 7 TAAs where botanical species of conservation concern are located, however MR/MM would minimize risk. Non-selective herbicide use may be needed near water (glyphosate).
Herbicide Toxicity/Wildlife: Relative risk to wildlife from herbicide use	Low risk of herbicide exposure to wildlife. The effects analysis assumes that an animal is directly sprayed, consumes an entire days’ diet of	Same as Alternative 1	Same as Alternative 1

Issue and Indicator	Alternative 1	Alternative 2	Alternative 3
	contaminated food, or drinks contaminated water for an entire day. These scenarios far overestimate actual exposure levels. The management requirements and mitigation measures would further reduce the potential impacts on wildlife.[18]		
Herbicide Toxicity/Aquatic Organisms: Relative risk to Aquatic Organisms from herbicide use	Herbicide use poses relatively low risk of impact to aquatic organisms. Aquatic glyphosate poses risk of non-lethal impact to fish, however the MR/MM minimize the potential for herbicide to reach streams.	Same as Alternative 1.	Same as Alternative 1
Herbicide Toxicity/Aquatic Organisms: First year/first choice use of aquatic glyphosate or triclopyr within aquatic influence zones	961 acres of aquatic glyphosate	926 acres of aquatic glyphosate	939 acres of aquatic glyphosate and 12 acres aquatic triclopyr

[18] This section was edited for clarity between the draft and final EIS.

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Chapter 3. Affected Environment and Environmental Consequences

3.1 Introduction

Chapter 3 of this EIS summarizes the environments of the affected project area (existing conditions) and the potential changes to those environments due to implementation of the alternatives discussed in Chapter 2 (environmental consequences). It also presents the scientific and analytical basis for the comparison of alternatives presented. For ease in presentation and comparison, the analysis discussions are separated into individual resources areas.

This Environmental Impact Statement (EIS) incorporates by reference (as per 40 CFR 1502.21) the Project Record, including specialist reports and other technical documentation used to support our analysis and conclusions. The record documents our various public outreach efforts. Analysis was completed for treatment effectiveness, human health, botany, soils, water resources, fisheries, soils, wildlife, recreation and scenery and heritage resources.

Biological Evaluations (BE) and Biological Assessments (BA) were also prepared in compliance with the requirements of Forest Service Manual (FSM) 2670, 2671, FSM W.O. Amendments 2600-95-7, and the Endangered Species Act (ESA of 1973, as amended. A Biological Assessment (BA) has been prepared in compliance with the requirements of Forest Service Manual (FSM) 2630.3, FSM 2672.4 and the Endangered Species Act of 1973 (Subpart B: 402.12, Section 7 Consultation, as amended) on actions and programs authorized, funded, or carried out by the Forest Service to assess their potential for effect on threatened and endangered species, and species proposed for federal listing (FSM 2670.1). The biological evaluations are in the Project Record and summarized in Chapter 3.

3.1.1 Treatment Analysis Areas

Known infestations were divided into larger geographic area known as a Treatment Analysis Area (TAA). This is the area where the known infestation is most likely to spread in the next 5 to 10 years if the original site is left untreated. Each TAA is within a single 5th field watershed and contain one or several invasive plant sites.

The Interdisciplinary Team developed the Management Requirements and Mitigation Measures (MR/MM) and described the Affected Environment based on the range of conditions within the TAAs.

Figure 2 shows the location of the TAAs. Maps and information about the infested areas within the TAAs is available on line at http://www.fs.fed.us/nepa/nepa_project_exp.php?project=34208. Appendix A provides an example of maps and information associated with the TAAs in the Project Record (and available on line).

Table 18 shows the infested acreage and number of sites estimated to currently grow within each treatment analysis area (TAA). Please note that these estimates provide a snapshot of the inventory prepared in 2012. This inventory is based on a variety of sources and not all sites have been validated by an invasive plant specialist. Validation by an invasive plant specialist would occur before treatment of any site. Invasive plants sites are subject to rapid change and may become larger or smaller during the analysis and implementation periods. Additional invasive plant sites that have not been inventoried or mapped are expected to occur within and outside the treatment analysis areas.

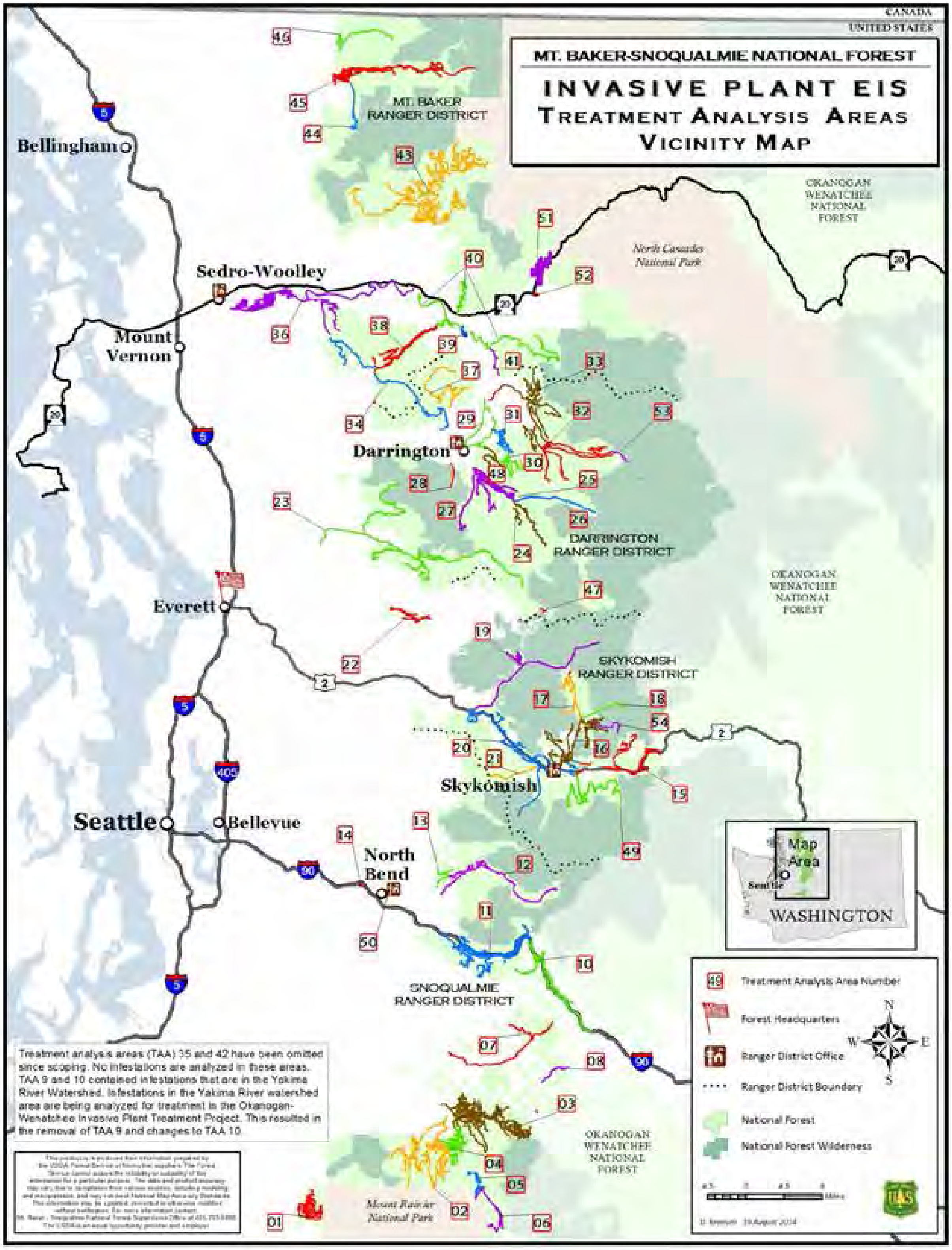

Figure 2. Treatment Analysis Areas Locator Map

Table 18. Infested Acres, Number of Sites and Target species within Treatment Analysis Areas

Treatment Analysis Area Number	Treatment Analysis Area Name	Infested Acres	Number of Sites	Target species
01	Evans Creek	2.9	2	Tansy ragwort
02	W. Fork White River	102.5	119	Bull thistle Canada thistle Common groundsel Common hawkweed Common tansy Cutleaf blackberry Diffuse knapweed Herb Robert Himalayan blackberry Meadow knapweed Scotch broom Spotted knapweed Tansy ragwort
03	Greenwater River	518.4	104	Bull thistle Canada thistle Common groundsel Common hawkweed Common tansy Diffuse knapweed Herb Robert Scotch broom Smooth hawkweed Spotted knapweed Tansy ragwort Wild carrot
04	The Dalles	697.5	74	Bird's foot trefoil Bohemian knotweed Bull thistle Canada thistle Common hawkweed Hairy cat's ear Herb Robert Oxeye daisy Scotch broom Spotted knapweed St Johnswort Tansy ragwort
05	Ranger Creek	0.4	7	Bull thistle Common groundsel European lily of the valley Scotch broom Tansy ragwort
06	Crystal Mountain Blvd	3.0	1	Tansy ragwort
07	Sunday Creek	11.2	6	Sulphur cinquefoil Spotted knapweed Tansy ragwort
08	Road 52	6.2	3	Canada thistle Spotted knapweed Tansy ragwort

Treatment Analysis Area Number	Treatment Analysis Area Name	Infested Acres	Number of Sites	Target species
10[19]	I-90 Corridor Kittitas County	0.1	1	Dalmatian toadflax
11	I-90 Corridor King County	114.2	49	Absinth wormwood Bohemian knotweed Common hawkweed Dalmatian toadflax Herb Robert Meadow hawkweed Meadow knapweed Orange hawkweed Scotch broom Spotted knapweed Sulphur cinquefoil Tansy ragwort Woolly hedgenettle Yellow archangel
12	Middle Fork Snoqualmie River	119.5	34	Butterfly bush Common comfrey Common periwinkle Common tansy Field bindweed Hedge false bindweed Herb Robert Rhubarb Scotch broom Tansy ragwort
13	Bessemer Road System	0.1	2	Bohemian knotweed
14	Snoqualmie Point	95.2	5	Butterfly bush Cutleaf blackberry Himalayan blackberry Scotch broom Tansy ragwort
15	Martin Creek-Tye River	45.0	17	Bohemian knotweed Bull thistle Common tansy Dalmatian toadflax Giant hogweed Herb Robert Orange hawkweed Tansy ragwort Yellow hawkweed
16	Lower Beckler River	161.1	49	Bohemian knotweed Bull thistle Canada thistle Common hawkweed Herb Robert Himalayan blackberry Japanese knotweed

[19] In the 2012 scoping package, Treatment Analysis Area 10 contained approximately 160 acres on the Okanogan-Wenatchee National Forest that are administered by the Mt. Baker-Snoqualmie National Forest. These acres were dropped from consideration in this EIS because they are in the Yakima Watershed and would have required a separate Endangered Species Act consultation (a small portion of the TAA remains). Treatment Analysis Area 09 contained 35 acres in the Yakima River Watershed that were also dropped from consideration. Planning for these areas will be completed on the Okanogan-Wenatchee National Forest.

Treatment Analysis Area Number	Treatment Analysis Area Name	Infested Acres	Number of Sites	Target species
				Orange hawkweed Scotch broom Spotted knapweed Sulphur cinquefoil Tall hawkweed Tansy ragwort Wild carrot Yellow hawkweed
17	Upper Beckler River	9.2	26	Bull thistle Canada thistle Common tansy Himalayan blackberry Orange hawkweed Scotch broom Sulphur cinquefoil Yellow hawkweed
18	Rapid River	0.5	2	Herb Robert Orange hawkweed
19[1]	North Fork Skykomish River	42.2	18	Bird's foot trefoil Bohemian knotweed Bull thistle Common hawkweed Common tansy Diffuse knapweed Hairy cat's ear Herb Robert Orange hawkweed Oxeye daisy Spotted hawkweed Yellow hawkweed
20	Highway 2 Corridor & Miller River	291.9	53	Bohemian knotweed Butterfly bush Canada thistle Dalmatian toadflax English holly English ivy Giant knotweed Herb Robert Jewelweed Orange hawkweed Scotch broom Smooth hawkweed Tansy ragwort Yellow archangel Yellow hawkweed
21	Money Creek	26.2	5	Bohemian knotweed Butterfly bush Herb Robert
22	Sultan River	1.5	13	Bull thistle Canada thistle Cutleaf blackberry Herb Robert Himalayan blackberry Oxeye daisy Reed canarygrass Scotch broom

Treatment Analysis Area Number	Treatment Analysis Area Name	Infested Acres	Number of Sites	Target species
23	South Fork Stillaguamish River	441.8	31	Bohemian knotweed Common hawkweed Common periwinkle Herb Robert Meadow hawkweed Orange hawkweed Policeman's helmet Yellow archangel
24	Fall Creek	326.8	5	Bohemian knotweed Japanese knotweed Scotch broom Spotted knapweed Tansy ragwort
25	Sauk-Whitechuck Confluence	0.1	1	Bohemian knotweed
26	White Chuck River Road 23	3.2	5	Herb Robert Orange hawkweed Tansy ragwort
27	Darrington South	351.8	7	Bohemian knotweed Herb Robert Japanese knotweed Orange hawkweed
28	Squire Creek	0.1	1	Bohemian knotweed
29	Sauk Prairie	19.7	21	Bohemian knotweed Canada thistle Cutleaf blackberry Hedge false bindweed Herb Robert Orange hawkweed Scotch broom Sulphur cinquefoil Tansy ragwort Yellow archangel
30	Dan Creek	6.4	19	Bull thistle Canada thistle Herb Robert Meadow hawkweed Orange hawkweed Tansy ragwort
31	Prairie Mountain	3.3	14	Canada thistle Herb Robert Meadow hawkweed Orange hawkweed Tansy ragwort
32	Circle Creek-Suiattle River	273.1	18	Canada thistle Common burdock Common tansy Herb Robert Orange hawkweed Scotch broom Sulphur cinquefoil
33	Big Creek-Tenas Creek	125.5	28	Canada thistle Common tansy Herb Robert Meadow hawkweed Orange hawkweed Scotch broom Sulphur cinquefoil

Treatment Analysis Area Number	Treatment Analysis Area Name	Infested Acres	Number of Sites	Target species
				Tansy ragwort Yellow hawkweed
34	Segelsen Pass Road 18	71.7	12	Bull thistle Common hawkweed Meadow hawkweed Orange hawkweed Scotch broom Spotted knapweed Yellow hawkweed
36	Sedro Woolley	364.0	25	Bittersweet nightshade Bohemian knotweed Butterfly bush Canada thistle Common burdock Common periwinkle Common tansy Common teasel English holly Herb Robert Himalayan blackberry Poison hemlock Reed canarygrass Scotch broom Tansy ragwort Yellow hawkweed
37	Crevice Creek	0.1	1	Yellow hawkweed
38	Finney Creek	132.7	8	Butterfly bush Herb Robert Meadow hawkweed Yellow hawkweed
39	South of Rockport	16.7	5	Bull thistle Canada thistle Common comfrey Cutleaf blackberry Yellow flag iris
40	Concrete to Rockport	65.1	16	Bohemian knotweed Bull thistle Butterfly bush Canada thistle Common tansy Herb Robert Himalayan blackberry Meadow hawkweed Orange hawkweed Tansy ragwort
41	Suiattle Mountain	0.1	3	Bull thistle Canada thistle Orange hawkweed
43	Baker Lake	8.9	62	Black locust Bohemian knotweed Bull thistle Butterfly bush Canada thistle Common tansy English ivy Giant knotweed Hawkweed non-native Herb Robert

Treatment Analysis Area Number	Treatment Analysis Area Name	Infested Acres	Number of Sites	Target species
				Japanese knotweed Reed canarygrass Scotch broom Spotted knapweed Sulphur cinquefoil Tansy ragwort Wild carrot
44	Glacier Creek Rd 39	1.1	1	Canada thistle
45	Mt. Baker Highway 542	231.3	32	Bohemian knotweed Bull thistle Common comfrey Common periwinkle Elephant ear English ivy Hedge false bindweed Herb Robert Himalayan blackberry Meadow hawkweed Orange hawkweed Spotted knapweed Tansy ragwort Wild carrot Yellow archangel
46	Canyon Creek	1.6	2	Canada thistle Orange hawkweed
47	Monte Cristo Townsite	0.1	1	Common hawkweed
48	South of Dan Creek	0.4	7	English holly Herb Robert Orange hawkweed
49	Tonga Ridge	111.4	4	Herb Robert Spotted knapweed Yellow hawkweed
50	North Bend compound	56.5	2	Bohemian knotweed Orange hawkweed
51	Diobsud Creek	8.9	9	Bohemian knotweed Canada thistle Common tansy Himalayan blackberry Scotch broom
52	Marblemount Boat Launch	7.3	5	Bohemian knotweed Canada thistle Common tansy Hedge false bindweed Scotch broom
53	Sulphur Creek	0.2	1	Herb Robert
54[20]	Johnson Ridge	0.0	0	scotch broom and others likely
Total Acres		**4,878**	**936**	

[20] Treatment Analysis Area (TAA) 54 was thought to contain 113 acres of oxeye daisy, which was included in the 2012 scoping package. This was later determined to be a misidentification; no oxeye daisy is growing in the Scorpion Mountain meadow. However, scotch broom was seen on a trail (old road) within TAA 54.

3.1.2 Site Characterization

Each invasive plant infestation lies within one or more site types. The number of sites and acreage of invasive plants that are currently mapped within each site type is shown in Table 19. Approximately 44 percent of the total infested acreage occurs on road shoulders, 25 percent of the infested acreage lies along stream banks, and 18 percent of the infested acreage is within or adjacent to plantations. The remaining acreage is a mix of forest land, wilderness, dispersed and developed recreation sites, administrative sites and other areas.

Table 19. Acreage and Number of Known Sites by Site Type

Type of Site	Number of Sites	Acreage
Administrative	25	60.4
Developed recreation	68	337.8
Dispersed recreation	6	50.6
Forested	278	332.6
Lake shore	15	1.7
Pasture/open space	50	481.6
Plantation	20	904.9
Powerline	3	12.0
Recreation residence	8	0.3
Road shoulder	435	2,212.2
Rockpit/stockpile	48	61.3
Ski slope	1	0.2
Stream bank	53	1255.3
Wilderness	6	4.0

3.1.3 Treatment Assumptions and Scenarios

The analysis in this chapter of the EIS is based on the assumption that none of the treatments would be considered 100 percent effective immediately after the initial entry. While initial entries in year 1 are estimated to eliminate 80 – 95 percent of the invasive plants at a site, maintenance entries would be required over subsequent years.

The following assumptions are relevant to the analysis in Chapter 3.

- In most cases, herbicide treatment would precede manual or non-herbicide because the non-herbicide treatments will be most effective when populations have been substantially reduced through the use of herbicides. In some cases, manual and mechanical treatments would occur in advance of herbicide treatments.
- The most ambitious treatment scenario for analysis purposes would be for all sites to have an initial treatment in the first year. The benefits and adverse impacts of treatment are likely to be less than predicted for the most ambitious scenario because funding and other constraints would limit the amount treated in any 1 year.
- Broadcast application refers to foliar application on dense (greater than 70 percent coverage) invasive plant populations. Spot/selective herbicide application means that backpack and hand equipment would be used to treat foliage or stems (e.g. cut stump, injection). Spot and selective treatments would generally occur where invasive plants cover less than 70 percent of a given acre.

- Spills are unlikely to occur and would be of small scale. Management Requirements/Mitigation Measure (MR/MM) 8 outlines the requirements of a spill reduction plan. The type of spills modeled in the risk assessments for the upper bound hazard quotient estimates (i.e. 200 gallons of herbicide mix spilling into a small pond) are not possible. No reportable spills have occurred on similar projects in Region Six (Desser 2013).

This project would be implemented over the next 5 to 15 years, as funding allows, or until conditions have changed sufficiently to warrant this EIS outdated. No more than 5,000 acres annually, or 13,500 acres of new detections found over the life of the project, would be treated with herbicide. Site-specific conditions are expected to change within the life of the project: treated infestations would be reduced in size, untreated infestations would continue to spread, and/or new invasive plants could become established within the project area.

3.1.4 Climate Change and Invasive Plants

Global climate change is predicted to alter precipitation and seasonal temperature patterns, as a result of increased levels of atmospheric carbon dioxide (CO_2) and other factors (Mote 2004). Most recent studies on the interaction between climate change and invasive plants conclude that climate change is likely to favor invasive plant species to the detriment of native plant species for individual ecosystems (Chornesky et al. 2005, Climate Change Science Program 2008, Dukes and Mooney 1999, Hellmann et al. 2008, Pyke et al. 2008). In some studies, invasive plant species have demonstrated increased growth rates, size, seed production, and carbon content in the presence of elevated CO_2 levels (Rogers et al. 2008, Rogers et al. 2005, Smith et al. 2000, Ziska 2003). Warming climates may remove elevation barriers to invasive plant distribution that currently exist. For instance, cheatgrass is becoming established in dry forests in the Intermountain West, particularly after wildfires and fuels reduction projects. After these events, native perennial grasses are lost, leaving potential cheatgrass habitat, which can increase fire frequency (Tausch 2008).

Many invasive plants are species that can thrive in the presence of disturbance and other environmental stressors, have broad climatic tolerances, large geographic ranges, and possess other characteristics that facilitate rapid range shifts. In a simulation experiment, Kremer et al. (1996) found that a less productive, invasive grass community would tolerate climate change, whereas a native sagebrush community would not survive the increased temperatures. The predicted changes in climate are thought to contribute additional stressors on ecosystems, including those on National Forests, making them more susceptible to invasion and establishment of invasive plant species (Joyce et al. 2008).

Climate change may affect invasive species differently. Bradley et al. (2009) found that rather than simply enhancing invasion risk, climate change may also reduce invasive plant competitiveness if conditions become climatically unsuitable. Climate change could result in both range expansion and contraction for some invasive plants in the western United States (potentially introducing invasive species that thrive in warmer conditions). Likely future conditions may also make management of invasive species more difficult. Treatments used on invasive plants may be less effective under various climate change scenarios and/or elevated CO_2 (Hellmann et al. 2008, Pyke et al. 2008, Ziska, Faulkner, and Lydon 2004).

Predicting how climate change will affect invasive plants, and invasive plant management, at the local or even regional scale is more difficult to deduce than are these general indications. Anticipated changes in the climate for the Pacific Northwest (e.g. more rain, less snow, warmer temperatures) (Mote 2004, Mote et al. 1999, National Assessment Synthesis Team 2000) or elevated CO_2 may not be realized at a local area, particularly within the time frame of this analysis. Growth of invasive plants under elevated CO_2 conditions will also be influenced by environmental conditions such as soil moisture, nutrient availability, and the plant community in which the invasive species occurs (Cipollini, Drake and Whigham 1993;

Curtis, Drake, and Whigham 1989; Dukes and Mooney 1999; Johnson et al. 1993; Taylor and Potvin 1997). The complex interaction of multiple and uncertain variables make site-specific predictions speculative.

Current science is insufficient to precisely determine a cause and effect relationship between climate change and the Proposed Action for the project area. A general conclusion, based on the preponderance of current literature, suggests that "most of the important elements of global change are likely to increase the prevalence of biological invaders" (Dukes and Mooney 1999, Bradley et al. 2010). The MBS will likely become more vulnerable to the establishment of invasive plant infestations, actual acreage affected by invasive plants could increase, and control strategies may become more difficult. Recommended management responses to these predictions are early detection (resulting from regularly scheduled monitoring) followed by a rapid response to eradicate initial infestations (Hellmann et al. 2008, Joyce et al. 2008, Tausch 2008).

Many of the invasive species on the MBS have originated in Eurasia and tend to thrive in warm sunny microsites (e.g. species in the sunflower family, Asteracea). Conversely most of the TES or S&M species on the MBS prefer cold, wet sites, are more common in Alaska and are either disjunct or at the southern extent of their range on the Mt. Baker-Snoqualmie National Forest.

Given that action alternatives include control of invasive plants with an early detection/rapid response component, and the large uncertainties regarding effects of climate change at any specific location over the time frame of this project, there is insufficient information to discern any meaningful differences between alternatives. All actions are consistent with recommendations for management response in the face of potential influences of climate change on invasive plants.

3.1.5 Introduction to Herbicide Toxicity Analysis

The effects from the use of any herbicide depends on the toxic properties (hazards) of that herbicide, the level of exposure to that herbicide at any given time, and the duration of that exposure. Risk assessments were completed by Syracuse Environmental Research Associates, Inc. (SERA) using peer-reviewed articles from the open scientific literature and current Environmental Protection Agency (EPA) documents, including Confidential Business Information to which SERA had clearance. Information from laboratory and field studies of herbicide toxicity, exposure, and environmental fate was used to characterize the risk of adverse effects to non-target organisms.

The risk assessments consider a variety of exposure scenarios including accidental exposures and application at maximum rates over relatively large areas. Although the risk assessments have limitations (see R6 2005 FEIS pages 3-95 through 3-97), they represent the best science available. "After 30 years of use and refinement, this risk-assessment paradigm has become scientifically credible, transparent, and consistent; can be reliably anticipated by all parties involved in decisions regarding pesticide use; and clearly articulates where scientific judgment is required and the bounds within which such judgment can be applied. The process is used for human-health and ecological risk assessments and is used broadly throughout the federal government. Thus, the committee concludes that the … risk assessment … process is singularly appropriate for evaluating risks posed to ecological receptors, such as listed species, by chemical stressors, such as pesticides" (NAS 2103). .

The risk assessments provide a range of human health and ecological impact results including lower, central and upper estimates. The upper value in the range would generally correspond to a "worst-case" value unlikely to actually occur for this project. For instance, workers would have to be exposed to maximum rates over the course of an 8-hour day; 200 gallons of herbicide would have to be spilled into a pond for accidental drinking water exposure scenarios; a woman would have to eat a pound of contaminated fruit; an animal would have to feed on nothing but contaminated vegetation over the course of a day; a fish would be exposed to herbicide following 10 acres of broadcast spray at maximum rates directly adjacent to a small stream. The central estimates also include assumptions that are unlikely to actually occur given the MR/MM associated with this project and the scattered nature of invasive plant applications.

Risk assessments have a high degree of uncertainty in interpretation and extrapolation of data. Uncertainty may result from a study design, questions asked (and questions avoided), data collection, data interpretation, and extreme variability associated with aggregate effects of natural and synthesized chemicals on organisms, including humans, and with ecological relationships. Due to data gaps, assessments rely heavily on extrapolation from laboratory animal tests (USFS 2005a).

Regardless of disadvantages and limitations of ecological and human health risk assessments, risk assessments can determine (given a particular set of assumptions) whether there is a basis for asserting that a particular adverse effect is possible. The bottom line for all risk analyses is that absolute safety can never be proven and the absence of risk can never be guaranteed (SERA 2007). Limited information on surfactants, adjuvants, and inert ingredients is available in Bakke 2007 and various risk assessments. Since risk assessments have not been completed for most surfactants, adjuvants and inert ingredients, information regarding the toxicity and effects of these chemicals is largely unavailable.

Herbicide risk assessments are available online at http://www.fs.fed.us/foresthealth/pesticide/risk.shtml and herbicide labels are available at http://www.fs.fed.us/foresthealth/pesticide/labels.shtml. Table 20 displays the risk assessment references associated with each herbicide proposed for use, and the maximum amount that would be applied via broadcast, spot or selective foliar sprays to effectively treat target species found on the forest. Infrequently, a greater concentration of herbicide may be selectively applied as per label guidance for stump cut or stem injection methods.

Table 20. Risk assessments for herbicides and surfactants considered in this EIS

Herbicide	Date Final	Risk Assessment Reference	Maximum Pounds active ingredient per acre per year (for target species on the MBS)
Aminopyralid	June 28, 2007	SERA TR-052-04-04a	0.09
Chlorsulfuron	November 21, 2004	SERA TR 04-43-18-01c	0.09
Clopyralid	December 5, 2004	SERA TR 04 43-17-03c	0.50
Glyphosate	March 25, 2011	SERA TR-052-22-03b	4.00
Imazapic	December 23, 2004	SERA TR 04-43-17-04b	0.13
Imazapyr	December 16, 2011	SERA TR-052-29-03a	1.25
Metsulfuron methyl	December 9, 2004	SERA TR 04-43-17-01b	0.075
Picloram	September 29, 2011	SERA TR-052-27-03a	1.00
Sulfometuron methyl	December 14, 2004	SERA TR 03-43-17-02c	0.2
Triclopyr	May 24, 2011	SERA TR 052-25-03a	2.00

Table 21 summarizes information about each of the herbicides proposed for use in one or more alternatives.

Table 21. Summary of Properties and Risks Associated with Herbicides Proposed for Use on the MBS

Active Ingredient Selected Herbicide Brand Names and Mode of Action	Properties	Risks
Aminopyralid (Milestone®, Milestone VM®) Mimics Auxin Plant growth hormone	Selective for most broadleaf species. Post emergent herbicide. Grasses are tolerant.	Potential to kill non-target broadleaf plants. Low risk to aquatic organisms. Milestone® formulations contain no inert ingredients other than water and triisopropanolamine (active ingredient in aminopyralid).
Chlorsulfuron (Telar®, Glean®, Corsair®) Sulfonylurea-Interferes with enzyme acetolactate synthase with rapid cessation of cell division and plant growth in shoots and roots.	Glean -Selective pre-emergent or early post-emergent Telar – Selective pre- and post-emergent. Both are for many annual, biennial and perennial broadleaf species. Safe for most perennial grasses, conifers. Some soil residue.	Moderate risk to aquatic organisms.
Clopyralid (Transline®) Synthetic auxin -Mimics natural plant hormones.	A highly trans-located, selective herbicide active primarily through foliage of broadleaf species. Little effect on grasses.	Contains hexachlorobenzene (persistent carcinogen) in amounts below a threshold of concern; this chemical is ubiquitous in the environment. Highly mobile, but does not degrade in water. Lower risk to aquatic organisms.
Glyphosate (35 formulations, including RoundUp®, Rodeo®, Accord XRT®, Aquamaster®, etc.) Inhibits three amino acids and protein synthesis.	A broad spectrum, non-selective trans-located herbicide with no apparent soil activity. Adheres to soil which lessens or retards leaching or uptake by non-targets.	Non-selective. Greater risk to aquatic organisms.
Imazapic (Plateau®) Inhibits the plant enzyme acetolactate, which prevents protein synthase.	Used for the control of some broadleaf plants and some grasses.	More potential to kill non-target vegetation. Lower risk to aquatic organisms.
Imazapyr (Arsenal®, Arsenal AC®, Chopper®, Stalker®, Habitat®) Inhibits the plant enzyme acetolactate, which prevents protein synthesis.	Broad spectrum, non-selective pre- and post-emergent for annual and perennial grasses and broadleaved species.	More potential to kill non-target vegetation. Moderate risk to aquatic organisms. Human health hazard associated with higher label rates. More mobile.

Active Ingredient Selected Herbicide Brand Names and Mode of Action	Properties	Risks
Metsulfuron methyl (Escort XP®) Sulfonylurea -Inhibits acetolactate synthesis, protein synthesis inhibitor, and block formation of amino acids.	Used for the control of many broadleaf and woody species. Most susceptible crop species in the lily family (i.e. onions). Safest sulfonylurea around non-target grasses.	More potential to kill non-target vegetation. Lower risk to aquatic organisms.
Picloram (Tordon K®, Tordon 22K®) Restricted Use Herbicide Synthetic auxin - Mimics natural plant hormones.	Selective, systemic for many annual and perennial broadleaf herbs and woody plants.	Most mobile, but persistent in soil. Contains hexachlorobenzene (persistent carcinogen) in amounts below a threshold of concern; this chemical is ubiquitous in the environment. More potential to kill non-target vegetation. Greater risk to aquatic organisms. Human health hazard associated with higher label rates.
Sulfometuron methyl (Oust®, Oust XP®) Sulfonylurea -Inhibits acetolactase synthase; a key step in branch chain amino acid synthesis.	Broad spectrum pre- and post-emergent herbicide for both broadleaf species and grasses.	More potential to kill non-target vegetation. Moderate risk to aquatic organisms. Human health hazard associated with higher label rates.
Triclopyr (Garlon 3A®, Garlon 4®, Forestry Garlon 4®) Synthetic auxin - Mimics natural plant hormones.	A growth regulating selective, systemic herbicide for control of woody and broadleaf perennial invasive plants. Little or no impact on grasses.	Greatest risk to aquatic organisms. Exposure may exceed thresholds of concern for workers and the public.

3.1.5.1 Impurities, Metabolites, Inert Ingredients, and Adjuvants

Forest Service risk assessments also include evaluated studies of potential hazards of other substances associated with herbicide applications: impurities, metabolites, inert ingredients, and adjuvants such as food coloring dyes. There is usually less toxicity data available for these substances (compared to the herbicide active ingredient) because they are not subject to the extensive testing that is required for the herbicide active ingredients under FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act).

Information on adjuvants and surfactants is tiered to the R6 2005 FEIS and incorporates updated information from Analysis of Issues Surrounding the Use of Spray Adjuvants with Herbicides (Bakke 2002, 2007), and the Summary of Aquatic Acute Toxicity Data for Spray Adjuvants Allowed for Use on Aquatic Sites in Washington (WSDA 2009). The SERA risk assessments also include information about additives that are part of herbicide formulations. NPE-based surfactants would not be used for this project, however alkylphenol ethoxylate ingredients may be used in oil and/or silicone blends. POEA surfactants would not be used.[21]

Many of the concerns expressed by the public about use of herbicides reflect hazards that could occur with chemical use or exposures that are beyond the scope of this project. This project tiers to the R6 2005 FEIS and incorporates the most recent SERA Risk Assessment for toxicology information. Concerns about the registration process, about chemical use at higher rates or about different pesticide formulations cannot be addressed in this project level document. This document does not reconsider findings and decisions made in the R6 2005 FEIS and ROD, however, it does incorporate findings from updated risk assessments. Additional information about surfactants is in Appendix E.

3.1.5.2 Herbicide Toxicology Terminology

The following terminology is used throughout this chapter to describe relative toxicity of herbicides proposed for use in the alternatives.

Aquatic Label: Some herbicides are labeled by EPA for direct application in water. While no direct application would occur in any alternative for this project, aquatic formulations may be required by the label or the buffers described in Table 10. Aquatic labeled herbicide formulations have been more extensively tested and tend to be less hazardous to aquatic organisms than the same herbicide in terrestrial formulations). However, aquatic labeled herbicide formulations may pose greater risk to aquatic organisms than some other herbicides that do not have aquatic labels. For instance, aminopyralid poses less risk to fish than aquatic labeled glyphosate.

Bioaccumulation: The increase in concentration of a substance in living organisms as they take in contaminated air, water, or food because the substance is very slowly metabolized or excreted (often concentrating in the body fat).

Exposure Scenario: The mechanism (for example, by skin or ingestion) by which an organism (person, animal, fish) may be exposed to herbicides active ingredients or additives. The application rate and method influences the amount of herbicide to which an organism may be exposed.

Threshold of Concern: A level of exposure below which there is a low potential for observable adverse effects to an organism. The No-observed-adverse-effect level (NOAEL) is the exposure level at which no statistically or biologically significant differences in the frequency or severity of any adverse effect in the exposed or control populations exists.[22] When a hazard quotient is less than 1, risk is extremely low for any observable adverse effects due to the particular exposure scenario, and it is considered below the threshold of concern. Exposure scenarios are very conservative and therefore the risk characterization or threshold of concern is sufficiently protective. This level was further reduced in the R6 2005 FEIS to add a margin of safety to the risk assessment process for Threatened and Endangered species. Lower threatened and endangered species thresholds were applied to all wildlife, fish and other aquatic organisms.

[21] POEA surfactant use was eliminated from the alternatives in response to public comments. This means that higher risk glyphosate formulations would not be used.
[22] The laboratory tests include organ/tissue examination/dissection, lethal and non-lethal effects (i.e., behavior changes and weight loss).

Hazard Quotient (HQ): The Hazard Quotient (HQ) is the amount of herbicide or additives to which an organism may be exposed (dose) divided by the exposure threshold of concern (No Observable Adverse Effect Level – NOAEL). An HQ less than or equal to 1 indicates an extremely low level of risk.

Lowest Observed Adverse Effect Level (LOAEL): The lowest dose of a chemical in a study, or group of studies, that produces statistically or biologically significant increases in frequency or severity of adverse effects between the exposed and control populations.

No Observable Adverse Effect Level (NOAEL): Exposure level at which no statistically or biologically significant differences in the frequency or severity of any adverse effect in the exposed or control populations exists.

No Observed Effect Concentration (NOEC): Synonymous with NOEL.

No Observed Effect Level (NOEL): Exposure level at which there are no statistically or biologically significant differences in the frequency or severity of any effect in the exposed or control populations.

Reference Dose (RfD): The RfD is a numerical estimate of a daily exposure to the human population, including sensitive subgroups such as children, that is below a level thought to cause harmful effects during their lifetime. RfDs are generally used for health effects that are thought to have a threshold or minimum dose for producing effects. The reference dose is also referred to as the level of concern, threshold of concern, and toxicity index. All of these terms refer to the exposure level or "dose" below which adverse effects are unlikely to occur.

Risk Assessment Worksheet: A spreadsheet that provides lower, central and upper estimates of hazard quotients for public and worker health, different types of wildlife, and aquatic organisms, using project-specific application rates and methods.

3.1.5.3 Incomplete and Unavailable Information Related to Herbicides

Any project involving herbicide use in a natural setting will contain many sources of uncertainty. The range of invasive plant species to be managed is large and compounded by the number of non-target species and diversity of ecological conditions in areas where treatment may occur. Data on herbicide toxicity and environmental fate is limited to those conditions and species tested for registration purposes and investigated by independent researchers. Available data on surfactants, inert ingredients, and dyes is even more limited. It is not possible to obtain all the data necessary to substantially reduce this information gap. For example, the sheer number of species and single herbicide test combinations would be overwhelming.

Each rigorous laboratory test conducted to determine the toxicity of a chemical to an animal is extremely expensive. If we add to this data required to more adequately address synergistic, additive, or antagonistic effects from chemical combinations, it is not possible to obtain all data that would be relevant to making a decision.

In addition, invasive and native plants, wildlife, soil and water bodies are dynamic resources that change locations and characteristics depending upon time, season, weather patterns, land use activities, random events, and other influences. This limits our ability to precisely predict effects (e.g. amount and duration of herbicide exposures, spread and impact of invasive plants, nature and amount of background contamination, etc.) even if more toxicity information was available.

For risk assessments considering adjuvants, surfactants and inert ingredients in herbicide mixtures, the information within the risk assessment may not be complete. SERA (2007) discussed how the risk assessments apply generally accepted scientific and regulatory methodologies to encompass these uncertainties in predictions of risk. SERA risk assessments identify and evaluate incomplete and unavailable information that is potentially relevant to human health and ecological risks. Each risk assessment identifies and evaluates missing information for that particular herbicide and its relevance to risk estimate. Such missing information may involve any of the three elements needed for risk assessments: hazard, exposure, or dose-response relationships. A peer-review panel of subject matter experts reviewed the assumptions, methodologies and analysis of significance of any such missing information. The SERA Risk Assessments incorporate the findings of this peer review.

The Forest Service responds to this uncertainty by:

1. Assuming adverse effects to organisms occur at doses well-below lethal levels
2. Using the best available models for predicting herbicide concentrations in water
3. Using worst case scenarios
4. Relying on widely used and accepted risk assessment methodology
5. Including MR/MM that restrict certain applications
6. Monitoring effects of higher risk treatments

Treatment Effectiveness

Each invasive plant treatment situation could respond differently to the integrated treatments proposed. The prescription for each site would vary depending on the MR/MM, buffers, first choice and other effective herbicides authorized for use, and other factors such as treatment history and objective. The differences in treatment effectiveness are based on assumptions about the range of treatments available. In addition, treatment costs vary depending on the integrated treatment methods, specific chemicals used and their application method, and the size and distribution of the various treatment sites.

Human Health

Toxicity data is not obtained on humans directly, but rather extrapolated from laboratory animals using standardized tests required by EPA. Human susceptibility to toxic substances can vary substantially. In response to this uncertainty, standard risk assessment methodology assigns uncertainty factors to toxicity data to account for extrapolation from laboratory animals and for sensitive individuals. However, some individuals may be unusually sensitive so individual susceptibility to the herbicides proposed in this EIS cannot be predicted specifically. Factors affecting individual susceptibility include diet, age, heredity, pre-existing diseases, and lifestyle. In response to this uncertainty, management requirements and mitigation measures are proposed to reduce the likelihood or amount of exposure.

Botanical Resources

Data on the susceptibility of different non-target plant species and families to particular herbicides is conducted with agricultural crop species and not those that may better represent non-target plants in the forest environment. Specific locations of rare plants, as well as invasive plants, change from year to year, making it impossible to precisely predict risk from treatments.

The current analysis uses the best available science on susceptibility, herbicide drift, and risk assessments to determine likely effects. Required management requirements and mitigation measures, monitoring, and practical information and expert opinion are utilized in response to uncertainty.

Soil and Water Resources

Herbicide toxicity and fate varies with environmental variables such as pH, temperature, and presence or absence of organic matter. These variables fluctuate widely depending upon season, weather, disturbance, adjacent land uses, and other factors, making precise predictions of existing conditions and effects impossible. Data on effects to soil organisms is limited and may not reflect the actual community of organisms present at any given treatment site.

In response to this uncertainty, the current analysis uses the best available scientific information on soil mapping, watershed analysis, water monitoring, and the best available predictive models for potential contamination and drift. In addition, management requirements and mitigation measures are applied to action alternatives to restrict herbicide ingredients, application method, and/or rate on certain soils and in proximity to water.

Terrestrial and Aquatic Organisms (Fish and Wildlife)

Research has not been conducted on the effects of these herbicides to most free-ranging wildlife species, so the relevant data to specifically evaluate effects to different wildlife species is incomplete or unavailable. Specifically:

- Information about herbicide effects to reptiles, amphibians and butterflies found in Region Six is limited.
- Analysis of effects for any project involving herbicide use relies upon extrapolations from laboratory animals to free-ranging wildlife and controlled conditions to the natural environment.
- There are more data available for mammals than for birds, which require the use of mammal toxicity values in bird exposure scenarios for some of the herbicides considered in this FEIS.
- Very few studies are available on sub-lethal effects to fish from acute exposures. Of studies that are available, some indicate temporary effects at low herbicide concentrations (e.g. Tierney et al. 2006).

Better estimates of risk could be calculated if laboratory data on the toxicity of the herbicides considered in this EIS were available for more groups of animals and more individual species. We would have more information on the comparative sensitivities of different wildlife groups and the types of adverse effects that may occur in different species.

However, because of the dynamic nature of wildlife and their habitat (behavior, weather, nutrient availability, contaminant presence, etc.), significant uncertainties would remain for predicting short- and long-term reactions to herbicide presence in natural settings even if more laboratory data were available.

Limitations notwithstanding, there is substantial scientific data on the toxicity of these herbicides to birds and mammals, as well as amphibians and some invertebrates. The data is generated by manufacturers to meet EPA regulations before an herbicide may be registered for use, and by independent researchers that have published findings in peer-reviewed literature. This data is analyzed according to standard risk assessment methodology to reach a characterization of risk for each herbicide. The summary of the available scientific evidence and our evaluation of reasonably foreseeable impacts are detailed in the following sections.

3.1.6 Introduction to the Cumulative Effects Analysis

3.1.6.1 Introduction

The Council on Environmental Quality (CEQ) regulations for the implementation of NEPA define cumulative effects as the "impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions…" 40 CFR 1508.7.

Cumulative effects are discussed where there is an effect to the environment which results from the incremental effect of the action when added to other past, present, or reasonably foreseeable future actions (40 CFR 1508.7). As is discussed throughout Chapter 3, the risks of direct and indirect adverse impacts from this project are relatively small in any one location or time. The project covers a large geographical area and would occur over approximately 15 years. The specific location of invasive plant treatments and the timing and location of other activities in relation to invasive plant treatments are uncertain.

This section is provided as a basis for cumulative effects analysis found in each individual resource section of Chapter 3. CEQ regulations do not require the consideration of the individual effects of all past actions to determine the present effects of past actions. Cataloging past actions and specific information about the direct and indirect effects of their design and implementation could in some contexts be useful to predict the cumulative effects of the proposal. The CEQ regulations, however, do not require agencies to catalogue or exhaustively list and analyze all individual past actions. Simply because information about past actions may be available or obtained with reasonable effort does not mean that it is relevant and necessary to inform decision making (40 CFR 1508.7). The baseline for cumulative effects analysis is expressed in descriptions of the No-Action Alternative.

All invasive plant treatment methods have the potential to damage individual non-target plants. Noise and worker activity can disturb wildlife and removal of vegetation can affect their habitat. If manual, mechanical or herbicide treatments create bare soil, erosion can be accelerated. Small amounts of herbicide or sediment could reach surface water and impact water quality/aquatic organisms. All treatments have the potential to injure a worker or result in other accidents; and all treatments would create jobs and cost money. There is little disagreement that the potential adverse impacts of non-herbicide invasive plant treatments are minor, small scale, and of short duration. The potential for non-herbicide treatments to result in effects of concern to the public is very low. The potential for cumulative effects from such treatments were discussed in the R6 2005 FEIS (Chapter 4-39, 4-50, 4-61 to 62, 4-89 to 4-90, and 4-122 to 123) and are incorporated by reference.

Aside from the cost-effectiveness of non-herbicide treatments, public issues focus on the effects of herbicide use in the alternatives. Some people have expressed concern that herbicide use from this project could combine with herbicide use elsewhere and have an additive, synergistic, or other cumulative effect; specifically the effects on wildlife, fish or people exposed to repeated doses of herbicides.

The focus of the following section is on the cumulative effects from proposed herbicide use combined with herbicide use elsewhere, however cumulative effects of vegetation management, recreation and other activities are also addressed in the resource cumulative effects sections.

3.1.6.2 Other Herbicide Use Within and Adjacent to the Project Area

The following section discusses what is known about herbicide use on other land ownerships adjacent to the project area, including adjacent federal, tribal, state, and private lands. Precise information about herbicide use off National Forest is not available; there is no requirement for land owners or counties to report herbicide use or other invasive plant treatment information, thus an accurate accounting of the total acreage of invasive plant treatment for all land ownerships is unavailable (R6 2005 FEIS page 4-1). Herbicide use within National Forests comprises less than 3 percent of overall herbicide use in Oregon and Washington (ibid). All herbicide use would follow label guidance and Washington state law. A recent report found that all agencies take extra care when herbicides are used in or near sensitive habitats (2004 Puget Sound Non-agricultural Pesticide Use Report).

The effectiveness of the prevention, treatment and restoration program on the MBS has the potential to influence treatments off the National Forest. Over time, more herbicide use may be required by other land owners and managers if invasive plants are not controlled on the MBS.

Sarah Callaghan, former Forest Invasive Plant Specialist obtained the following information regarding herbicide treatments made by federal, state, and county agencies adjacent to the MBS in 2013. Herbicide use on these lands would vary from year to year throughout the life of the project.

Federal

Herbicides are used on Mount Rainier National Park. Approximately 16 infested acres were treated in 2013. Manual and mechanical integrated with spot herbicide on small targeted infestations using aminopyralid, clopyralid, glyphosate, imazapyr and triclopyr. [23] National Park staff also report using fluroxypyr, an herbicide that is not 1 of the 10 currently approved in the R6 2005 ROD.

The Bonneville Power Administration conducts manual, mechanical and herbicide treatments on right-of-ways near the MBS. Herbicide use includes low volume foliar spray of glyphosate and triclopyr. Approximately 250-400 acres are treated annually with herbicide.

State

The Washington State Department of Transportation uses a variety of herbicides along state highways (approximately 146 acres were treated along highways that cross the MBS in 2013; of these about 113 acres were within the project area). Many of the herbicides used by the Department of Transportation are not 1 of the 10 currently approved in the R6 2005 ROD.

The Washington State Department of Natural Resources-North Bend area treated 95 aces containing 18 invasive plant species in 2013. The treatments included manual control and herbicides. Glyphosate, clopyralid and triclopyr were the herbicides used on state lands. Approximately 727 acres on 40 miles of road adjacent to the MBS were treated within Iron Horse Trail State Parks. Herbicides used include aminopyralid, 2,4-D, picloram, and triclopyr.

Counties

Counties are responsible for controlling invasive plants along county roads and other county property outside of and within the MBS. They also work with conservation districts, invasive plant management areas, and watershed councils to control invasive plants on private property.

Snohomish County mainly uses mowing to control invasive plants on roadsides adjacent to the MBS. Less than 1 acre was treated using glyphosate in 2013. Kittitas County sprayed 2 to 3 acres using aminopyralid and clopyralid on lands adjacent to the MBS in 2013. King County treated about 100 acres adjacent to the MBS using herbicides and manual controls in 2013.

[23] This information was corrected based on comments from the Department of the Interior.

Other Herbicide Use

Herbicides may also be used on tribal lands, private timber lands, on agricultural lands and within residential areas. Information about herbicide use on these lands is unknown.

3.1.6.3 Invasive Plant Spread and Cumulative Effects

Ground disturbance associated with natural processes such as wildland fire, and human activities, such as road use, may favor the spread of invasive plants and discourage the reestablishment of native species. Seastedt et al. 2008, notes that human caused disturbance can change soil conditions to which native species have adapted, which further results in conditions that favor invasive plants. Repeated road clearing and graveling, an open gravel pit, or a cleared compacted recreation area create environments that favor colonists species or vegetation that can optimize a large volume of soil with a taproot or species which germinate quickly, grow and set seed during the limited growing conditions of the site. Roadside environments have coarser texture growing substrate with higher rock content and thus represent growing environments that favor invasive plants (Gelbard and Belnap 2003).

Generally, disturbed environments have greater available resources for invasive plants because of exposed soil, open light, and higher nutrient and water availability. Shade under forest canopies substantially limits invasive plant growth. However, some of the invasive species on the MBS do invade shaded environments (for example, herb Robert).

Vehicle traffic is considered the major vector for invasive plant seeds since long stretches of roadways have invasive plants and vehicles cover large distances that can pick up and deposit seeds into new areas (Trombulak and Frissell 2000, Zouhar 2008, Flory and Clay 2009, Birdsall et al 2011).

Past and ongoing projects and activities on the MBS National Forest have the potential for inducing invasive plant spread where soils are disturbed. Table 22 discusses the site types where invasive plants are currently found and the risk of spread in these areas. Table 23 discusses types of land uses and activities that have the potential for spreading invasive plants. All projects on the MBS include measures to prevent the spread of invasive plants and many include active restoration to help native plant communities resist infestation.

Roadsides have the highest greatest potential for invasive plants to become established and spread because vehicle traffic provides a constant source of invasive plant seeds onto disturbed road fill and cutslopes. Rock pits have high hazard for spreading invasive plants since the pits have barren, open sites for growing invasive plants and materials moved to new construction sites.

The MBS NF has ongoing program for decommissioning roads. This program fluctuates with program dollars available. Invasive plants pose issues with road decommissioning (Switalski et al. 2004) from both the invasive plant seeds persisting from prior use and the reclaimed ground having open sites for occupation by invasive plants. The initial 1 to 10 years of reclamation would have high potential for invasive plants establishing, while thereafter forest canopy and brush species would gradually secure and limit the available site for invasive plants to establish. Invasive plant treatments on these roads become more difficult as the vegetation closes and access is limiting.

Recreation areas have ongoing risk for invasive plants from outside transport on vehicles and recreation traffic. Approximately 8 percent of the area has invasive plant infestations at recreation sites. Compact soils from trampling limit natural vegetation growth, allowing openings for invasive plants to grow. However, large soil displacement is rare from construction activities as opposed to ongoing grading and mowing along roads. Thus, this risk is less than for roadsides.

In contrast, timber harvest activities pose primarily periodic to one-time hazards for introducing invasive plants. Forest harvest activities have invasive plants that can come in on equipment, workers and animals. The disturbance is one-time for most of the harvest openings, although bare skid trails, log landings and burn piles can re-vegetate at slower rates creating open sites for invasive plants to colonize. Invasive plants often occupy disturbed skid trails and log landing sites (Birdsall et al. 2011). Burn piles on the log landings and within the timber site favor exotic invasive plant establishment with higher alkalinity, higher available nutrients and open sites for occupation (Meyer et al. 2009).

Effective treatment coupled with prevention can greatly reduce invasive plant persistence in these areas. As opposed to roads with ongoing traffic spreading invasive plants, the threat for continued invasive plant spread decreases in logged areas as the forest canopy closes and understory shrubs and tree regeneration compete for soil resources.

Grassy areas comprise about 8 percent of the acreage within mapped infestations. Disturbed grassy areas are susceptible to invasive plant spread, although grass cover can effectively outcompete invasive plants. Invasive plants can take advantage of the nutrient-rich soil biological community within grassy areas.

Powerline rights-of-way make up a small percentage of the invasive plant sites, covering 0.2 percent of the current inventoried invasive plant infestations. The maintained open canopy and erosive slopes associated with minimal engineered road access create open site conditions. The robust shrub cover and natural understory do deter invasive plants. Incursion may follow the road access disturbance. The limited access compared to open roads lessens continued invasive plant spread.

High elevation sites such as ski areas and wilderness are less susceptible to invasive plant invasion since their climate is outside the growth range of most of the listed invasive plants. However, invasive plants have been found along access roads (roads, trails) and other disturbed high elevation areas. These areas may become more susceptible to infestation over time as a response to climate change.

Table 22. Risk of Invasive Plant Spread by Site Descriptions

Type of Site	Acreage	Risk	Reasons
Road shoulder	2,212	Very High	High annual seed from vehicles where busy, disturbed surface
Rockpit/stockpile	61	Very High	Bare open surface, seeds transported to bare roads
Recreation and administrative sites	360	Very High	Annual seed dispersal from people and vehicles on disturbed, impaired soils
Stream bank and lakeshores	1,270	High	Annual water and animal seed dispersal on semi disturbed surface from water fluctuation
Plantation and forests	909	Moderate	One-time invasive plant dispersal from timber harvest and planting activities, periodic from animal dispersal on initial disturbed surface and longer term disturbed roads and landings
Grassy Areas	482	Moderate	Periodic dispersal on altered soils from historic land use
Powerline Rights of Way	12	Moderate	Periodic dispersal from tree clearing, maintenance work along access roads
Wilderness	4	Low	Annual dispersal along trails and campsites, although low overall since high elevation sites outside most invasive plant's range.
Ski slope	<1	Low	Periodic dispersal from maintenance on highly erosive open slopes, but high elevation sites outside most invasive plant's range

Table 23 displays the potential disturbance frequency and intensity and invasive plant propagule pressure associated with various pathways of invasive plant spread. Disturbance frequency and intensity and propagule pressure strongly influence the rate that invasive plants are likely to spread along vectors. The most applicable R6 2005 ROD standard dealing with preventing the spread of invasive plants via each vector is also shown.

Table 23. Potential for Invasive Plant Spread from Projects and Activities

Project Type that could impact non-target vegetation	Disturbance Frequency/ Potential Maximum intensity	Most Applicable R6 Management Direction/ Prevention Considerations	Restoration Considerations	Cumulative Effect Considerations
Recreation Projects (other than road use)	Perpetual/ low	R6 Goal 1, Objectives 1.2; 2.4, 2.5; Standards 1, 4 n Outreach and education n Travel management n Recreation management	Perpetual disturbance could make restoration of native vegetation difficult; implement mitigation in recreation projects to decrease risk of impacts to desirable vegetation.	Areas with heavy recreation impacts are also most likely to have re-infestation of invasive plants.
Road maintenance, construction, reconstruction and use. Rock pit management.	Perpetual/ High	R6 Goals 1, 2; Objectives 1.1, 1.3, 1.5 2.3; Standards 1, 2, 3, 13	Consider seeding and mulching, and/or planting to encourage desirable vegetation where invasive pressure and potential for recovery is greatest. Ensure that rock used on roads within the National Forest is free of invasive plant seeds.	These activities have direct impacts to non-target vegetation through ground disturbance (clearing) of plants and indirect effect by increasing the potential for introduction of noxious invasive plants, which displace desirable species.
Closing roads	Periodic/ Low	R6 Goals 1, 2; Objectives 1.1, 2.4, 2.5; Standards 1, 2, 7, 8, 13 n Coordination with engineering staff, quarries are inspected and road materials are invasive plant free	Consider seeding, mulching, and planting to establish desirable vegetation during to road closure process.	Cumulative benefit to road closure, less potential for vectoring; access limitations can complicate invasive treatment. Conversely, closing roads would tend to have a cumulative benefit to prevention of invasive spread.
Restoring roads and landings	One time/ Low	R6 Goal 2; Objective 2.4; Standards 1, 2, 3, 13	Consider seeding, mulching, and planting to establish desirable vegetation.	Cumulative benefit to restoration, less potential for invasive spread; access limitations can complicate invasive treatment.

Project Type that could impact non-target vegetation	Disturbance Frequency/ Potential Maximum intensity	Most Applicable R6 Management Direction/ Prevention Considerations	Restoration Considerations	Cumulative Effect Considerations
Stream Restoration (e.g. fish passage and habitat projects, riparian vegetation restoration).	Seasonal/ High	R6 Goal 5; objectives 5.1-5.3	Encourage riparian vegetation	Restoration projects such as installation of fish structures have the potential to impact (remove) riparian vegetation and/or introduce invasive plants through contaminated equipment. Stream restoration would tend to have a cumulative benefit to invasive spread
Vegetation Management (Thinning and brushing, logging, burning)	Periodic/ High (especially within skid trails, yarding corridors, landings, and areas of slash pile burning)	R6 Goals 1,2; Objectives 1.1, 2.1, 2.2; Standards 1, 2, 3, 13	Skid trails and yarding corridors may need to be mulched, seeded or planted. General forestlands usually have an abundant native plant seed source.	Off-road equipment can spread invasive plants but prevention intended to minimize impact.
Mining and Mine Restoration	Periodic/ Moderate	R6 Goal 2, Objectives 2.1, 2.2; Standards 1, 2, 3, 7, 8, 10	Ensure that reclamation and mine cleanup activities do not result in spread of invasive plants.	Mining and mine restoration can spread invasive plants but prevention measures and reclamation are intended to minimize impact.

3.1.6.4 Other Ongoing or Foreseeable Projects in the Planning Area

Several projects are occurring or are being planned within the MBS National Forest. Information about projects that were recently completed, are being implemented or are ongoing, or are planned to be implemented in the foreseeable future are displayed in Appendix F.

Recently completed projects on the MBS include closing and restoring roads; road construction, reconstruction and maintenance; vegetation management (mainly thinning); and recreation development and maintenance. These projects occur within treatment analysis areas mapped within the project area (TAA 4, 15, 19, 23, 26, 27, 41, 43, 44, and 45) where invasive plant treatment sites occur within or near the recently completed projects. Several projects are currently being implemented or are ongoing on the MBS. These include mining; a variety of recreation projects; road repair, closure, reconstruction/improvement, decommissioning and maintenance; stream restoration; and vegetation management (thinning and created openings). Projects are being implemented in TAA 2, 3, 4, 5, 6, 11 15, 16, 17, 20, 23, 27, 30, 32, 33, 36, 41, 43, 45, 47, 49 and 53.

Several projects are planned to be implemented in the foreseeable future. These include recreation and site maintenance; road closure, repair and reconstruction; vegetation management (mainly thinning and some created openings) and stream restoration. The projects overlap invasive plant treatments proposed in TAA 2, 4, 6, 11 14, 19, 23, 32, 33, 38, 32, 43, and 45. These projects may last for several years.

Most of these projects have the potential to contribute to conditions that favor invasive plants, however integrated weed management principles and prevention measures would slow or eliminate their spread. Prevention measures are routine, enforceable and effective in vegetation management projects. Cleaning equipment, protecting invasive plant sites from disturbance, and reseeding skid trails and landings have reduced the spread of aggressive invasive plant species on the MBS.

Although invasive plant spread may be associated with some of these projects, the cumulative impact of EDRR treatment within the scope of this project is limited by the Management Requirements and Mitigation Measures listed in Table 9. The EDRR strategy would play a critical role in keeping new infestations small. The predictions in Chapter 3.2 regarding invasive plant spread over the life of the project incorporate assumptions about introductions of invasive plants from forest use and other human activities on and off the MBS. The effects of recent past, current, ongoing and foreseeable future projects are unlikely to combine with the effects of this project, because the impacts from the invasive plant treatments are small and are dispersed in time and space.

3.1.6.5 Summary of the Basis for Cumulative Effects Analysis

While this project may occur throughout the MBS and over an extended period of time, the risk of adverse impacts on people and the environment from invasive plant treatment at any one time and place is low. This limits the potential for this project to combine with another project and cause cumulative adverse effects on people, animals, or the environment.

The cumulative effects analysis assumes that legal use of herbicides is occurring on the other ownerships described above. Treatments on other ownerships are influenced by the effectiveness of treatments on the MBS and thus, increased treatment on the MBS might not equate to more invasive plant treatment overall. Mark Boyar of the Middle Fork Coalition on behalf of several environmental interest groups noted in their DEIS comment letter that if treatments are ineffective on the MBS, herbicides "will be used anyway, but likely in greater quantities than would have been necessary had the infestations been controlled at their source."

The acreage proposed for treatment is relatively small and the invasive plants to be treated are widely scattered. This dilutes the potential for the impacts of this project to overlap with impacts of other projects. The effects of herbicide use are mainly limited to the site of application. Drift from broadcast treatments is unlikely to harm non-target vegetation more than 100 feet away from treated areas. Spot and selective treatments are far less likely to move off site (7-15 feet for lethal effects to native vegetation).

The invasive plant sites are scattered throughout the Forest and the project would be implemented over 10 to 15 years, thus, there is likely to be spatial and temporal with other projects. However, the risk of direct and indirect adverse effects of invasive plant treatments have been minimized, thus there is little potential for the *effects* of this project to overlap in time and space with *effects* of other projects. Herbicides are unlikely to drift, leach or run off into surface waters and harm aquatic organisms, given the herbicide use buffers described in Table 10.

The cumulative effects analysis assumes that invasive plants will be treated on lands adjacent to the MBS and herbicide applicators would likely be repeatedly exposed to herbicides. People and animals could be exposed to repeated doses of herbicides. However, risk assessments and the R6 2005 FEIS (pages 4-1 to 4-3) found that repeated exposures would not result in cumulative effects because the herbicides proposed for use are rapidly eliminated from the bodies of people and animals. For effects of repeated exposures to be additive, the repeated exposure would have to be simultaneous, such as a person contacting herbicide directly, while eating sprayed vegetation and drinking contaminated water. In summary, factors that limit the potential for cumulative effects from herbicide use proposed in the action alternatives include the following:

- The risk of adverse effects of invasive plant treatments in all action alternatives has been minimized by the MR/MM, treatment caps and herbicide use buffers applicable to known sites and new detections. Predicted herbicide exposures are very small compared to likely background downstream conditions, and are not likely to trigger cumulative adverse effects to neither people nor the environment.
- In general, invasive plant sites are small and scattered.
- Herbicide residues from past treatments in most locations would be broken down or adhered to organic matter or soil particles within less than 1 year of application. Herbicides such as aminopyralid, imazapyr, metsulfuron methyl and picloram can persist for more than 1 year under some conditions and may result to some accumulation in soils at the invasive plant treatment site. This is managed through MR/MM 26 that limits repeated applications of persistent herbicides.
- Early detection rapid response is part of Alternatives 2 and 3, and is considered in the direct, indirect and cumulative effects analysis. Effects of treatments each year under early detection rapid response, by definition, would not exceed the annual and life of the project caps. Treatment caps further restrict the spatial and temporal extent of impacts from this project.
- Multiple herbicide exposures on National Forest System land are unlikely to occur in close enough proximity in time or space with other applications to combine and cause cumulative effects. Infestations that cross ownership boundaries are often treated cooperatively so the effects are limited to the existing infestation and immediately surrounding areas.
- The R6 2005 FEIS (pp. 4-1 to 4-3) and SERA Risk Assessments discussed effects of chronic exposure to low levels of herbicides used to treat invasive plants on National Forest System land. Chronic exposures do not result in cumulative effects because the herbicides are more rapidly excreted from organisms (people, animals and fish) than would be absorbed from predicted levels of exposure. Thus, an animal could encounter herbicide in more than one location over time; however there would be no possibility for this project to result in exposures that could cause a cumulative effect.

3.2 Treatment Cost-Effectiveness

3.2.1 Introduction

This section discusses how the design of each alternative influences the cost and likelihood of success eradicating, controlling, and containing invasive plants on the MBS. The cost-effectiveness of each alternative is influenced by the tools available for use; the more tools available, the greater the potential effectiveness of the treatment. If the toolbox is restricted and some situations cannot be effectively treated, the percentage of target population killed each year can be dramatically decreased. On page 4-18, the R6 2005 FEIS notes that “alternatives that have the widest variety of herbicides and herbicide families available for use have the greatest potential to result in effective treatments.” In contrast, when herbicide use is more restricted, “fewer acres would likely be achieved at a constant budget and the years to control increases proportionally” (ibid. p. 4-21). Thus, a loss of effectiveness is likely if the most effective herbicide choice is not available for a given site.

Herbicide resistance may occur if one herbicide is used repeatedly in an area over a series of years (R6 2005 FEIS p. 3-94). More than one herbicide active ingredient may be needed to ensure that herbicide resistance does not occur. The repeated use of one herbicide could allow naturally resistant plants to survive and reproduce. As the number of resistant plants increases, the efficacy of the herbicide diminishes until the herbicide no longer effectively controls the invasive plant populations. To develop resistance avoidance strategies, long-term site plans should recognize which of the various herbicide families have available and effective herbicides if multiple applications are expected to be necessary. Integrated chemical and non-chemical controls are highly effective where feasible because any surviving herbicide resistant plants can be removed from the site. If timely and effective integrated treatments methods are implemented, reliance on herbicides would decrease over time.

In Alternative 2, the most effective herbicide and treatment method is proposed. Treatment effectiveness would be increased compared to Alternative 1, because in Alternative 1, the broadcast application method is not available for about 2,470 acres and the first choice herbicide is not available on an additional 357 acres. Compared to Alternative 2, Alternative 3, would also be less effective, because the first choice herbicide is not available on about 2,455 acres. Less effectiveness would increase costs and could compromise the ability to control or eradicate populations of some aggressive target species, such as hawkweeds and knapweeds. Limitations on application method and herbicide selection would compound over time. Herbicide use could have to be repeated on more acres or over a longer time for Alternatives 1 and 3.

Alternative 2 (Proposed Action) utilizes all available tools and thus is assumed to reduce populations by 80 percent per year. Effective treatment on a given site would be about 80 percent effective, meaning that there would be 80 percent fewer invasive plants in the treated area the year following treatment, assuming fully effective integrated weed management methods are used. A reduction of about 80 percent of the target species is generally expected from forestland herbicide treatments, however actual results can vary widely (Desser 2008, Dr. Tim Miller, Washington State University, personal communication 2014; Vanelle Peterson, Dow Chemicals, personal communication 2014).

Results at any treatment site vary depending on factors such as treatment objective, the target species, the size of the infestation, and the seed bank in the soil. The estimate of 80 percent reduction assumes that about 20 percent of the existing target population would remain after each treatment entry and that on average, four treatment entries would be required. Remnant target plants and seed banks can remain for several years but after four entries, invasive plants at any given site would be substantially reduced. The cost estimate assumes that all known infestations are treated the first year following a decision on this project, and then treated in three subsequent entries over a total of 4 years.

The 80 percent effectiveness concept is expressed as a decrease in the number of acres estimated to need treatment each year. For instance, a 100 acre infestation effectively treated in Year 1 would result in 20 acres needing treatment in Year 2. These 20 acres treated in Year 2 would result in 4 acres still needing treatment Year 3. Although this assumption is applied to acres; more likely there would be 80 percent less *density* of invasive plants within the infested area, rather than 80 percent *fewer acres*.

If the toolbox is restricted, fewer invasive plants would be effectively removed each treatment entry. Alternative 1 would be less effective on each treatment entry because it would not include broadcast treatment, nor would the first choice (most effective) herbicide be available for some acres. In Alternative 1, effectiveness is estimated to be reduced from 80 to 60 percent on about 2,470 acres that are proposed for broadcast application in Alternative 2. Spot treatments in these areas would likely leave gaps, increasing the acreage that would need to be re-treated each year. Also, where broadcast treatments are warranted but not allowed, successful control or eradication would be unlikely, and containment would be likely the best outcome expected.

Under Alternative 1, effectiveness would also be reduced on an additional 357 acres where the first choice herbicide is not currently approved. Effectiveness would be reduced from an estimated 80 percent to 70 percent per year on these acres.

For Alternative 3, aminopyralid would not be available, resulting in an estimated 10 percent loss of effectiveness per year. This would apply to about 2,455 acres where aminopyralid would be the most effective choice. In addition, the herbicide use buffers for streams would be larger (e.g. spot treatments would be required) on approximately 274 acres that could no longer be broadcast because aminopyralid is the only herbicide that could be broadcast to the water's edge. Treatment effectiveness would be reduced to 60 percent per year on these acres.

Treatment costs are estimated to range from about $110 per acre for mechanical treatment to about $200 per acre for manual treatment. For herbicide use, broadcast acres cost an average of $120 per acre and spot/selective treatments cost about $185 per acre. (Callaghan July 2012 personal communication). In this analysis, each treatment acre, whether spot or broadcast herbicide or a non-herbicide method, is assumed to cost $200 to accommodate the full range of treatment options at any given site.

Planting, seeding and/or mulching is recommended for 2,636 acres (Potash Botany Report 2012). While specific costs would vary, an average of $500 per planted, seeded, or mulched acre was used (USDA 2008a and 2008b). The analysis assumes that by the fourth treatment entry, planting, seeding and mulching recommended for restoration would be completed (see Appendix B for restoration needs for currently known sites, based on their 2012 condition).

The analysis does not include the costs of planning, monitoring or overhead. The analysis assumes each infestation is treated separately, however because about 20 percent of the infested acreage is co-located, some efficiencies may be gained if more than one target species is treated at the same time.

3.2.2 Alternative 1 - No Action

The No-Action Alternative (Alternative 1) is the least effective alternative. Some herbicide ingredients and mechanical methods would not be used. The broadcast application method would be restricted to Skiyou Island only, which would reduce potential effectiveness from 80 percent of the invasive plant population per year to 60 percent on about 2,470 acres, due to increased potential for skipped areas associated with spot treatment. The first year/first choice herbicide would not be available for an additional 337 acres, reducing effectiveness to 70 percent on these acres. Effectiveness would be the same for the remaining 2,071 acres where treatments would be the same as Alternative 2 (80 percent). Thus, Alternative 1 would have a weighted average effectiveness of 69 percent. The total cost estimate (assuming adequate budget to treat all infestations in a single year, then retreating remaining infestations each year for 4 years) would follow the pattern described below:

- Year 1, all 4,878 acres are treated. At $200 per acre, the cost year for year 1 amounts to about $975,600. About 31 percent of the acreage would need re-treatment, or about 1,512 acres remaining.
- Year 2, 1,512 acres are treated. At $200 per acre, the cost for year 2 amounts to about $302,400. About 31 percent of this acreage would need re-treatment, or about 469 acres remaining.
- Year 3, 469 acres are treated. At $200 per acre, the cost for year 3 amounts to about $93,800. About 31 percent of this acreage would need re-treatment, or about 146 acres remaining.
- Year 4, 146 acres are treated. At $200 per acre, the cost for year 4 amounts to about $29,200. About 31 percent of this acreage would need re-treatment, or about 45 acres remaining. Some areas may not be fully controlled or eradicated.

- Restoration is assumed to occur in year 5 for 2,636 acres for a total cost of $1,318,000.
- Total cost of Alternative 1 over the 5 year period is $2,719,000. Average cost of each treated/restored acre amounts to about $557 per acre.

Given current budgets estimated at $200,000 per year (Callaghan personal communication, 2013), Alternative 1 would take an estimated 14 years to meet treatment objectives possible under Alternative 1. Alternative 1 would not be likely to result in eradication and/or control of dense or large infestations.

3.2.3 Alternative 2 – Proposed Action

The Proposed Action, Alternative 2, would allow the most effective treatment method and herbicide ingredient on all known infestations, with an 80 percent reduction in invasive plant acreage each treatment entry. An estimated average of about 20 percent of the infestation would need to be retreated each year due to lingering seedbank and missed areas. The total cost estimate (assuming adequate budget to treat all infestations in a single year, then retreating remaining infestations each year for 4 years) would follow the pattern described below:

- Year 1, all 4,878 acres are treated. At $200 per acre, the cost year for Year 1 amounts to about $975,600. About 20 percent of the acreage would need re-treatment, or about 976 acres remaining.
- Year 2 976 acres are treated. At $200 per acre, the cost for Year 2 amounts to about $195,200. About 20 percent of this acreage would need re-treatment, or about 195 acres remaining.
- Year 3, 195 acres are treated At $200 per acre, the cost for Year 3 amounts to about $39,000. . About 20 percent of this acreage would need re-treatment, or about 39 acres remaining.
- Year 4, 39 acres are treated. At $200 per acre, the cost for Year 4 amounts to about $7,800. About 20 percent of this acreage would need re-treatment, or about 8 acres remaining. This is considered “maintenance level” and likely to be treated with limited use of herbicide for particularly aggressive species or established seedbanks.
- Restoration is assumed to occur in Year 5 for 2,636 acres for a total cost of $1,318,000.
- Total cost of Alternative 2 over the 5-year period is $2,535,600. Average cost of each treated/restored acre amounts to about $520 per acre.

Alternative 2 has the best chance of controlling and eradicating populations of invasive plants, including the largest, densest and most aggressive noxious weeds sites on the MBS. The total cost of treating known infestations and restoring favorable vegetation in a 4-year period would be least for this alternative. The average cost per restored acre is least. Given a fixed budget and current funding levels, Alternative 2 would take at least 12 to 13 years to effectively treat currently mapped sites.

Alternative 2 is estimated cost about $520 per restored acre. Alternative 2 would not exceed about $7.5 million assuming all known sites are effectively treated, along with 13,500 additional EDRR acres detected over the life of the project.

3.2.4 Alternative 3

Alternative 3 would not approve aminopyralid, which is the most effective treatment method and herbicide ingredient on about 2,369 acres of known infestations. Because aminopyralid would not be approved, the potential effectiveness would be reduced by an estimated 10 percent, down from 80 percent per year to 70 percent per year on these acres (professional judgment). Of these acres, spot treatments would be required on approximately 274 acres that could no longer be broadcast because aminopyralid is the only herbicide that could be broadcast to the water’s edge (see table 48 in Water Resources Chapter 3.7 for more information about treatments within the aquatic influence zone), reducing the potential treatment effectiveness to 60 percent. About 2,509 acres would have the same treatment as Alternative 2, with the same estimate of effectiveness (80 percent reduction of invasive plants per year). The weighted average effectiveness amounts to about 74 percent, based on about 2095 acres estimated at 70 percent effective (due to loss of aminopyralid as the first choice), about 274 acres estimated at 60 percent effective (due to loss of aminopyralid broadcasting near streams), and about 2,509 acres estimated as 80 percent effective (because they include the same first choice herbicide as Alternative 2). Approximately 26 percent of the treated population is estimated to remain after treatment, (as compared to 31 percent in Alternative 1 and 20 percent in Alternative 2).

Alternative 3 would not be likely to result in full eradication and/or control of dense or large infestations that are near streams. This would mean that our objective would become containment, rather than control or eradication, on about 274 acres.

The total cost estimate (assuming adequate budget to treat all infestations in a single year, then retreating remaining infestations each year for 4 years) would follow the pattern described below:

- Year 1, all 4,878 acres are treated. At $200 per acre, the cost year for Year 1 amounts to about $975,600. About 26 percent of the acreage would need re-treatment, or about 1,268 acres remaining.
- Year 2, 1,268 acres are treated. At $200 per acre, the cost for Year 2 amounts to about $253,600. About 26 percent of this acreage would need re-treatment, or about 330 acres remaining.
- Year 3, 330 acres are treated. At $200 per acre, the cost for Year 3 amounts to about $66,000. About 26 percent of this acreage would need re-treatment, or about 86 acres remaining.
- Year 4, 86 acres are treated. At $200 per acre, the cost for Year 4 amounts to about $17,200. About 26 percent of this acreage would need re-treatment, or about 22 acres remaining. Some areas may not be fully controlled or eradicated.
- Restoration is assumed to occur in year 5 for 2,636 acres for a total cost of $1,318,000.
- Total cost of Alternative 3 over the 5-year period is $2,630,400. Average cost of each treated/restored acre amounts to about $539 per acre.

Given a fixed budget and current funding levels, Alternative 3 would take about 13 years to accomplish. Alternative 3 is estimated cost about $539 per restored acre. The average cost per acre would be increased by about 4 percent compared to Alternative 2 (Proposed Action). Assuming all known sites are effectively treated, along with 13,500 additional EDRR acres detected over the life of the project, the project could cost up to 10 million dollars.

3.2.5 Effect of Alternatives on Invasive Plant Treatment Objectives

Treatment objectives have been identified for each site, based on the target species, size of the infestation, and location. Restrictions in the treatment toolbox would influence whether or not the objectives can be effectively met. If all tools are available, including use of aminopyralid and broadcasting where needed (Alternative 2), invasive plants could be eradicated on about 220 acres, controlled on about 3,321 acres and contained on about 1,481 acres.

Under the No-Action Alternative (Alternative 1), treatment objectives would not likely be met on all acreage because the most effective herbicide choices would not be available in all situations, and broadcasting would not be allowed (except for Skiyou Island). This would tend to decrease acreage that may be controlled or eradicated, and increase acreage that may be contained. Under Alternative 3, no aminopyralid would be used, therefore broadcasting would not be allowed to the water’s edge. This could influence whether or not infestations could be controlled on about 274 acres.

Table 24. Comparison between Objectives for No Action and the Action Alternatives

Treatment Objective	Acres Alternative 1	Acres Alternative 2	Acres Alternative 3
Contain	2,504	1,368	1,642
Control	2,284	3,290	3,016
Eradicate	90	220	220
Estimated acres where ability to control or eradicate target species may be compromised due to broadcasting restrictions (containment could still be achievable)	1,200	0	274

3.2.6 Effectiveness of Early Detection and Rapid Response (EDRR)/"New Invader" Approach

The alternatives differ in the process for treating newly detected invasive plants and responding to changes in the size or condition within known sites. The intention of the action alternatives is to reduce the time between detection of new of changed sites and their treatment compared to the current new invader strategy.

Table 25. Comparison of EDRR/New Invader Strategy between No-Action and Action Alternatives

No Action	Action Alternatives	Effectiveness
Based on the previous year's surveys, new invasive plant infestations would be documented [using the forms in Appendix D of the 2005 EA].	Invasive plant sites and treatment plans would be mapped according to Forest Service policy. Data bases such as NRIS and FACTS are used to track invasive plant populations and treatments.	The action alternatives do not require "previous year surveys." New detections could be treated rapidly as long as the implementation planning process is followed and the treatment is consistent with MR/MM, herbicide use buffers and project caps.
New infestation sites would be prioritized.	All sites proposed for treatment would be prioritized depending on the potential for adverse effects on the environment from the invasive plant. Priority would be determined in cooperation with federal, state and county agency partners and other interested parties.	The more high priority areas treated, the greater the effectiveness of the project.
The current "set" of high-priority sites would be included in each year's prioritization, which could result in a newly-discovered site being ranked as a higher priority for treatment.	New and known sites would be treated according to priority, with some exceptions, for instance, if a medium or lower-priority infestation can be treated as part of another planned project, or as part of a suite of restoration projects within a watershed.	The more high priority areas treated, the greater the effectiveness of the project. Treatment of medium or lower priority infestations would also help restore desired vegetation in treated areas. Treating new detections before they are well established would increase project effectiveness.

No Action	Action Alternatives	Effectiveness
Once a new site is ranked as a high priority, an initial proposed treatment and restoration plan would be selected, based on the type of invasive plant, size of infestation, and location. Tools to make this assessment would include, but not be limited to: the biology of each invasive plant species and their control history [Appendix C of the 2005 MBS EA]; and MBS specific experience with treating invasive species [Appendix B, of the 2005 MBS EA]. The only treatment methods available for selection would be those included in the [2005 MBS] EA, along with all Management Requirements and Mitigation Measures.	The implementation planning process includes developing integrated treatment prescriptions according to MR/MM based on a comprehensive list of site considerations. This project does not include herbicide application directly to water, aerial application of herbicides, use of any pesticides other than herbicides, treatment of aquatic invasive plants (floating and submerged), treatment of native plants, and changes in land uses to slow or prevent the spread of invasive plants. Otherwise, treatments that are consistent with MR/MM, herbicide use buffers, and treatment caps would be considered in the scope of the action alternatives.	In the action alternatives, the MR/MM and herbicide use buffers are intended to minimize adverse effects of treatment without impeding the Forest's ability to rapidly and cost-effectively treat invasive plants.
A new annual newsletter would be produced each spring, listing the new sites. It would be mailed to all interested parties, including agencies (such as U.S. Fish and Wildlife Service (USFWS), and NOAA Fisheries), Tribes, and others. Comments would be solicited.	No annual newsletter required. Notification would occur as per the MR/MM. Consultation with tribes and ESA regulatory agencies would occur as agreed.	The intent of the action alternatives is to minimize the paperwork necessary to treat new detections, and to avoid having to wait for an annual newsletter to be produced before treatment can occur on the ground.
For each new, high-priority site: the effects on other resources from treatment/restoration would be estimated. This information would be included in the newsletter.	No additional effects analysis is required for treatments within the scope of the action alternatives. As long as MR/MM, herbicide use buffers, and project caps are properly applied, any treatment that is not specifically excluded may be implemented.	Cost-effectiveness of treatment would be increased by not having to "estimate" effects that have already been disclosed in this NEPA document.
If the effects are found to be within the scope of this EA, and USFWS and NOAA Fisheries concur through informal Section 7 (ESA) consultation, sites would be added as addenda.	Report as agreed as a result of Section 7 Consultation.	All alternatives would include coordination and reporting to ESA regulatory agencies. No change in cost-effectiveness would be expected.
All treatments would be accomplished as funding is available.	No change.	Cost-effectiveness is influenced by funding. Infestations that are not treated due to funding constraints are likely to continue to spread or become more dense and expensive to treat.

3.2.7 Cumulative Effects on Treatment Effectiveness

Chapter 3.1.6 describes the what is known about invasive plant treatments occurring on lands adjacent to the MBS. The efforts of several county, state and federal agencies would complement effective treatments and restoration occurring on the MBS. The cumulative effect of treatments within and adjacent to the MBS would be beneficial because invasive plants can spread between different land ownerships and management agencies. The more acres effectively treated, the less potential for spread.

Implementation of prevention measures would have a beneficial impact on treatment effectiveness. Prevention reduces the rate of spread of invasive plants; however it is unlikely that rate of spread could ever reach zero because some vectors are outside Forest Service control and some infestations are already so large that they cannot be rapidly controlled or contained.

A cumulative benefit would be expected from implementing effective prevention measures and effective treatments. This would reduce the acreage of invasive plants subject to spreading along with reducing the rate of spread. Species and site-specific models do not exist to more precisely predict the rate of spread and the influence of prevention. An integrated invasive plant management program is considered the most effective way to meet invasive plant objectives and follow policies, standards and guidelines.

3.2.8 Alternative Comparison, Cost-Effectiveness

A summary of the information described above, along with the life of the project estimated costs are shown in Table 26.

Table 26. Summary of the Treatment Cost-Effectiveness Analysis

Treatment Acres and Costs	No Action Alternative 1	Proposed Action Alternative 2	No Aminopyralid Alternative 3
Acres Treated Year 1	4,878	4,878	4,878
Cost Year 1 in Dollars	975,600	975,600	975,600
Acres Treated Year 2	1,512	976	1,268
Cost Year 2 in Dollars	302,400	195,200	253,600
Acres Treated Year 3	469	195	330
Cost Year 3 in Dollars	93,800	39,000	66,000
Acres Treated Year 4	146	39	86
Cost Year 4 in Dollars	29,200	7,800	17,200
Restoration Cost Year 5	1,318,000	1,318,000	1,318,000
Total Cost in Dollars Known Sites Treatment Plus Restoration	2,719,000	2,535,600	2,630,400
Average Cost Per Treated/Restored Acre in Dollars	557	520	539
Years to Effectively Treat Known Sites given budget estimate of $200,000 per year	14	12-13	13
Maximum Cost in Dollars, Assuming Average Cost Treatment Plus Restoration applied to known sites plus 13,500 EDRR acres.	NA	9.5 million	10 million
Estimated acres where ability to control or eradicate target species may be compromised due to broadcasting restrictions (containment could still be achievable)	1,200	0	274

3.3 Human Health

3.3.1 Introduction

This section focuses on the health effects to workers and the public from herbicide use proposed in the alternatives. The R6 2005 FEIS and its Appendix Q: Human Health Risk Assessment detailed the potential for health effects from manual and mechanical treatments as well as the use of 10 of the herbicides proposed for this project and is incorporated by reference in this EIS. Four of the risk assessments that were incorporated into the R6 2005 FEIS were updated in 2011 (imazapyr, glyphosate, picloram, and triclopyr). This section includes findings from the new risk assessments based on herbicide application rates proposed for this project.

The Proposed Action would also add a new herbicide, aminopyralid, which is likely to be more effective on many of the target species found on the MBS, with less risk of adverse effects. The risk assessment for aminopyralid (SERA 2007) is the primary source of toxicological information about that herbicide.

Herbicide active ingredients, metabolites, inert ingredients, and adjuvants and people with herbicide sensitivity are addressed in the risk assessments and the R6 2005 FEIS.

Hazards normally encountered while working in the woods (strains, sprains, falls, etc.) are possible during herbicide and non-herbicide invasive plant treatment operations. Such hazards are mitigated through worker compliance with occupational health and safety standards and are not at issue for this project-level analysis. No unusual circumstances have been found requiring the need for additional human health analysis for non-herbicide treatments. For more information on potential hazards associated with non-herbicide treatments, see the R6 2005 FEIS Chapter 3.5.

Herbicide toxicity (herbicide impact on human health) is a key issue, even though herbicide use is already approved on the MBS and risk assessments indicate that herbicide exposures as a result of this project are unlikely to harm human health. This conclusion is based on facts about chemistry of the herbicides considered for use and the mechanisms by which exposures of concern might occur. Impacts to worker and public health would only be expected under extreme and unlikely exposure scenarios, such as a child drinking water from a pond contaminated by a spill, or a worker ignoring routine safe herbicide handling and application practices.

The use of herbicide in the action alternatives would be according to label requirements, with further restrictions in the R6 2005 ROD (MBS Forest Plan) standards. For example, treatment restoration standard 15 requires application be performed or directly supervised by a licensed applicator; standard 16 includes restrictions on tank mixtures; and standard 23 requires timely public notification and signing of treatment areas. Project-specific Management Requirements and Mitigation Measures (MR/MM) also are intended to reduce risk of herbicide exposure to the public.

Invasive plant infested sites are scattered throughout the MBS and occupy less than 1 percent of National Forest System lands on the Forest. Invasive plant treatments on the MBS are implemented through Forest Service contracts or in partnership with county crews. Applicators are generally from the communities in and around the MBS and are well-trained in safe herbicide handling and transportation practices. No environmental justice issues have been raised for this project.

Regulatory Framework

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) establishes the US system of pesticide regulation to protect applicators, consumers and the environment. It is administered by the Environmental Protection Agency (EPA) and the appropriate environmental agencies of the respective states. FIFRA requires registration for all herbicides, after extensive testing to evaluate whether a pesticide has the potential to cause adverse effects on humans, wildlife, fish, and plants, including endangered species and non-target organisms, as well as possible contamination of surface water or ground water from leaching, runoff, and spray drift.

When registered, a label is created to instruct the applicator on the proper usage of the material and required personal protective equipment. EPA also must approve the language that appears on each pesticide label and the product can only be used legally according to the directions on the labeling accompanying it at the time of sale.

The Forest Service is authorized by FIFRA and the Cooperative Forestry Assistance Act to use pesticides for multiple-use resource management and maintenance of the quality of the environment as long as the actions comply with the National Environmental Policy Act and the Council on Environmental Quality regulations. Forest Service Manual (FSM 2150) and Forest Service Handbook (FSH 2109) provide direction on safe use of pesticides, including direction on storage and transport, and development of safety plans and emergency spill plans.

Analysis Methodology

This analysis incorporates analysis in the R6 2005 FEIS and scientific risk assessments completed by Syracuse Environmental Research Associates, Inc. (SERA). Appendix Q of the R6 FEIS summarizes information about the human health hazards associated with herbicide use. The risk assessments include peer-reviewed articles from the open scientific literature and current EPA documents, including Confidential Business Information. Along with active ingredients, the assessments also reviewed herbicide additives, inert ingredients, and impurities, where information was available. Hexachlorobenzene (present as an impurity in picloram at 8 parts per million, and in clopyralid at much lower levels) was also evaluated.

To assess human health risks this analysis compares the dose of herbicide received by a worker or a member of the public under each exposure scenario with the corresponding herbicide "Reference Dose" (RfD) established by EPA or by the Forest Service/SERA risk assessment for acute and/or chronic exposures. If doses from estimated exposures for a specific Forest Service herbicide application are less than the RfDs, there would be no indication of a risk of health effects.

RfDs are established by taking the no observable adverse effect level (NOAEL) for each herbicide and then adjusting it to compensate for uncertainty. Most frequently, a RfD is 1/100th of the lowest NOAEL, but it may be even lower in some cases. The RfD is also referred to as the toxicity threshold or threshold of concern. The Hazard Quotient (HQ) is the ratio of the estimated level of exposure compared to the RfD. When a predicted dose is less than the RfD, then the HQ (dose/RfD) is less than 1, and toxic effects are unlikely for that specific herbicide application (i.e., the use is *presumably* safe). No chemical is studied for all possible effects and the use of data from laboratory animals to estimate hazard or the lack of hazard to humans of other species is an uncertain process. Thus, prudence dictates that normal and reasonable care should be taken in the handling of any chemical.

The risk assessments and project specific risk assessment worksheets quantify expected exposures and calculate the HQ's. These worksheets provide a range of values (lower, central and upper) rather than rely on a single estimate. The upper exposure estimates are based on the maximum estimate for every exposure factor that is considered, which is very unlikely to occur in our operations (e.g., maximum application volume, maximum concentration in field solution, maximum volume of a spill, maximum residue rates on food items, maximum exposure rates, maximum hours worked). The upper exposure estimates are not reflective of the way herbicides would be used in this project and the probability of maximum exposures occurring is very low. Thus, the central and lower estimates provide more realistic risk assessment results and are reported here. Three of the herbicides proposed in one or more alternatives (aminopyralid, imazapyr and metsulfuron methyl) did not have any HQ values greater than 1, even for the upper estimates. HQ values for the upper estimates are available in the project files, however, they are not considered plausible for this project and are not discussed further in the human health analysis.

Even considering central or lower HQ estimates, many of the exposure scenarios for the general public are implausible or extremely conservative. The general public is unlikely to be directly exposed treated areas. Estimates of longer-term consumption of contaminated water are based on estimated application rates throughout a watershed; however, only small portions of a watershed would be treated. Exposure scenarios based on longer-term consumption of contaminated vegetation assume that an area of edible plants is inadvertently sprayed and that these plants are consumed by a person over a 90-day period. While such inadvertent contamination might occur, it is extremely unlikely to happen as a result of directed applications (e.g., backpack applications). Even in the case of boom (broadcast) spray operations, the spray is directed at target vegetation and the possibility of inadvertent contamination of cultivated or edible vegetation would be low. In addition, for herbicides and other phytotoxic compounds, it is likely that the contaminated plants would show obvious signs of damage over a relatively short period of time and would therefore not be consumed (SERA 2007).

3.3.2 Affected Environment

Many people live near, spend time in, work in, or depend on forest products from the Mount Baker-Snoqualmie National Forest. Some dispersed and developed recreation areas (e.g., trailheads, campgrounds, picnic areas, recreation sites, boat ramps) and traditional gathering and special forest product collection areas currently occur in or near the vicinity of invasive plant sites. People engaged in these activities could potentially be inadvertently exposed to herbicides from treatment of invasive plants in or near these areas. Invasive plants are most prevalent along roads that provide access for a variety of public uses.

Several species of mushrooms, berries, roots, and herbs, some of which have cultural importance to traditional gatherers, occur on the MBS. Cultural plants are used for food and baskets and traditional gathering is essential to the maintenance of tribal traditions and culture. Gathering is also economically important. Gatherers return to the accustomed gathering areas of their ancestors to tend and harvest plants to be used for traditional purposes. Passing these traditions on to future generations preserves conservation ethics and ecosystem stewardship that have evolved over generations.

3.3.3 Environmental Consequences

3.3.3.1 Worker Herbicide Exposure Analysis

The risk assessments include analysis for both workers and the general public. This section focuses on the risks of proposed herbicide application to applicators themselves. Herbicide applicators are more likely than the general public to be exposed to herbicides, and may handle undiluted herbicide concentrate during mixing and loading. In routine broadcast and spot applications, workers may contact and internalize herbicides mainly through exposed skin, but also through the eyes, mouth, nose or lungs. Worker exposure is influenced by the application rate selected for the herbicide, the number of hours worked per day, the acres treated per hour, and variability in human dermal absorption rates.

All herbicides can cause irritation and damage to the skin and eyes if mishandled. Eye or skin irritation would likely be the only overt effect because of mishandling these herbicides. These effects can be minimized or avoided by prudent industrial hygiene practices during handling. Worker exposure can be effectively managed through ordinary prudent practices and use of personal protective equipment (PPE) required for applicators.

Appendix Q: Human Health Risk Assessment of the R6 2005 FEIS, the 2007 Aminopyralid Risk Assessment, and the updated 2011 Risk Assessments summarize risks for backpack and broadcast spraying under normal application and maximum exposures. Exposure levels that were evaluated range from predicted average exposure to worst-case exposure. Risks from accidental/incidental exposures are also displayed. Backpack spray exposures assume that workers on average treat a little more than four acres per day (ranging from 1.5 to 8 acres per day) and broadcast spray exposures assume that workers average 112 acres per day (ranging from 66 to 168 acres per day). For all scenarios, it is assumed that the workers do not receive any protection from exposure provided by clothing.

Accidental worker exposures are most likely to involve splashing a solution of herbicides into the eyes or on the skin. Two general types of exposure are modeled: one involving direct contact with a solution of the herbicide and another associated with accidental spills of the herbicide concentrate onto the surface of the skin. Exposure scenarios involving direct contact with herbicide solutions are characterized by immersing unprotected hands for 1 minute or wearing contaminated gloves for 1 hour. Workers are not likely to immerse their hands in herbicide; however, the contamination of gloves or other clothing is possible.

Exposure scenarios involving chemical spills onto the skin are characterized by a spill onto the lower legs as well as a spill onto the hands. In these scenarios, it is assumed that a solution of the chemical is spilled onto a given surface area of skin and that a certain amount of the chemical adheres to the skin.

The maximum rates proposed for use on the MBS were evaluated for this EIS. Most of the herbicides proposed for use under all alternatives have low potential to harm workers. In most cases, even when maximum rates and upper exposure estimates were considered, HQ values were below the threshold of concern (HQ values below 1). The only herbicide that resulted in HQ values that exceed 1 is triclopyr.

Triclopyr is unique among the herbicides considered for this project in that it has two different formulations that are commonly used; a triethylamine salt (TEA) version and a butoxyethyl ester (BEE) version. This is relevant to human health risks because esters are much more readily absorbed through human skin than are amine formulations. Therefore, the risk analysis for triclopyr was conducted for both versions.

For triclopyr, at the maximum application rates that could be used for this project, only one scenario exceeded HQ values greater than 1 at the central estimate. Triclopyr BEE at the central estimate of workers using contaminated gloves for an hour slightly exceeded the threshold of concern with an HQ of 1.5. This is considered an accidental, rather than operational exposure, because it does not comply with standard safety practices. This is a small exceedance of the level of concern, but is still nearly 100 times less than the NOAEL and does not approach any known toxicity concern. No HQ greater than 1 was calculated for workers using central estimates for triclopyr TEA.

In addition to herbicides, the contaminant HCB was quantitatively assessed. The cancer risk from all the worker operational exposures to HCB in picloram or clopyralid are at least two orders of magnitude below the risk standard of one chance in a million, which indicates an inconsequential risk.

3.3.3.2 Public Herbicide Exposure Analysis

The general public is unlikely to be exposed to high levels of any herbicides used in the implementation of this project. The SERA Risk Assessments considered several exposure scenarios including direct contact, consumption of sprayed vegetation, consumption of drinking water adjacent to a spray operation, and consumption of fish in water adjacent to a spray operation. Accidental exposures including drinking water from a pond contaminated by a large spill were also considered. No reportable spills have occurred on similar projects in Region Six (Desser 2013).

Direct Contact: Exposure is quantified from direct spray and contact with sprayed vegetation scenarios. At the maximum application rates proposed in any alternative, low risk to human health are indicated from direct contact. No scenarios for direct spray or contact with sprayed vegetation resulted in HQs greater than 1. The MR/MM include specific notification and posting requirements for administrative and recreation sites to further reduce the possibility of inadvertent direct spray of a member of the public.

Indirect Contact: Quantitative estimates of exposure were conducted for an adult female swimming for 1 hour in water contaminated by runoff from a treated 10-acre slope. All herbicides had HQs orders of magnitude below 1 for this scenario, indicating no plausible risk to the public from this exposure.

Eating Contaminated Vegetation or Fruit: The public could be exposed to herbicide if they eat contaminated vegetation or fruit after spraying, such as berries, mushrooms, or other plants. Directly sprayed plant materials would likely show signs of either dye or herbicide damage, reducing the likelihood they would be consumed. Non-target berries or mushrooms could also be contaminated by drift or uptake from the soil, which would result in lower herbicide residues than direct spraying. The R6 2005 FEIS and the risk assessments considered both one-time acute exposure (eating 1 pound) and chronic 90 day consumption scenarios for eating contaminated vegetation and fruit. These scenarios also approximate the effects of eating other contaminated products, such as mushrooms (Durkin and Durkin 2005). At the central estimate, only triclopyr resulted in a HQ greater than 1 for either acute or chronic exposures from eating contaminated vegetation, berries or other forest products. For both the triclopyr TEA and BEE formulations, acute consumption of contaminated vegetation had an HQ of 6. Consumption of fruit did not exceed an HQ of 1.

An additional analysis was done for triclopyr for public scenarios involving ingestion of contaminated food or water. Triclopyr has a metabolite, 3,5,6-trichloro-2-30 pyridinol (TCP), which is more toxic to mammals than triclopyr. TCP and its relevance to human health risk are discussed in detail in the Triclopyr Risk Assessment (SERA 2011). For TCP, acute consumption of contaminated vegetation is the only scenario that exceeded the threshold of concern, with an HQ of 1.8. Assuming dose addition for triclopyr and its metabolite, the total HQ for consumption of sprayed vegetation would be 7.8.

The total HQ of 7.8 is based on reproductive risks to females. Adverse developmental effects in mammals have been observed during laboratory experiments at doses that cause obvious signs of maternal toxicity. No epidemiology studies or case reports have associated human exposures to triclopyr at proposed rates with maternal or developmental effects.

Drinking Contaminated Water: Acute and long-term exposures from consumption of contaminated water were evaluated in the R6 2005 FEIS and the risk assessments. Risks from drinking contaminated water were evaluated for an accidental spill as well as water contaminated by runoff. The risk assessments also evaluated an accidental exposure scenario where a small child drinks 1 liter of water from a quarter-acre pond, into which the contents of a 200-gallon tank that contains herbicide solution is spilled, immediately following a spill.

No herbicides resulted in HQs greater than 1 for drinking contaminated water in either acute or chronic scenarios. All calculated HQs were many orders of magnitude below the threshold of concern.

Consuming Contaminated Fish: Both acute and long-term exposure scenarios involving the consumption of contaminated fish were evaluated using the herbicide concentrations in the contaminated water scenarios described above. Acute exposure was based on the assumption that an angler consumes fish taken from contaminated water shortly after an accidental spill into a pond. Chronic exposures were assumed to occur over a lifetime of eating contaminated fish. People who subsist on fish (for example Native American Indians) could have higher exposure rates than recreational anglers. However, based on a lifetime of subsistence fish consumption, no HQ values greater than 1 are associated with the herbicide use proposed in any alternative.

The risk assessments for picloram (SERA 2011) and clopyralid (SERA 2004) also quantitatively assessed chronic risk from HCB for consumption of contaminated fish by subsistence populations. The HQ for carcinogenicity for picloram was 0.4; below the level of concern. Likewise, the HQ for clopyralid is below the level of concern (clopyralid has much less HCB than does picloram).

The HQs for TCB for consumption of contaminated fish are all orders of magnitude below the level of concern, and do not approach 1, even if added to the HQs for triclopyr.

Summary

The response to quantitative results of HQ's greater than 1 has been to more fully develop actions to limit and reduce the exposures that led to the increased risk. As required by herbicide labels, workers are expected to wear required PPE and follow standard industrial hygiene practices, like replacing gloves should they become contaminated. The R6 2005 ROD (MBS Forest Plan) prohibits broadcast spraying of triclopyr, which reduces the chance of non-target edible vegetation from becoming contaminated. Public notification of planned treatments, including extra posting of notices at recreation and other developed sites would allow the public to avoid treated areas. In addition, triclopyr would not be applied to edible target plants (berries) when fruit are present. All relevant MR/MM are discussed below by alternative.

Surfactants or other adjuvants could be used according to label and Standard 18. Many surfactants could cause eye irritation.

Table 27 shows HQ values greater than 1 for worker and public exposure scenarios.

Table 27. Scenarios and herbicides where hazard quotients (HQ) exceeded 1.0 for human health.

Exposure Scenarios	HQ Central Estimates
Accidental– Worker Contaminated Gloves for 1 Hour	Triclopyr BEE HQ = 1.5
Acute – Consumption of Contaminated Vegetation	Triclopyr TEA & BEE HQ = 6
Acute - Consumption of Contaminated Vegetation	TCP HQ=1.8

Endocrine Disruption

The potential for the proposed herbicides to cause endocrine disruption effects was addressed in each risk assessment.

The United States Environmental Protection Agency has determined that there is no evidence to suggest that clopyralid or metsulfuron methyl has an effect on the endocrine system (SERA 2004). Based on the chronic bioassays and several additional subchronic bioassays in mice, rats, dogs, and rabbits, there is no basis for asserting that aminopyralid would cause adverse effects on the immune system or endocrine function (SERA 2007). No evidence for chlorsulfuron producing direct effects on the endocrine system was found (SERA 2004).

The glyphosate risk assessment (SERA 2011) stated that "some recent studies raise concern that glyphosate and some glyphosate formulations may be able to impact endocrine function through the inhibition of hormone synthesis (Richard et al. 2005; Benachour et al.2007a,b), binding to hormone receptors (Gasnier et al. 2009), or the alteration of gene expression (Hokanson et al. 2007)" (all references as cited in SERA 2011). Evaluation of the studies indicates that endocrine disruption effects were indicated for surfactants in the formulations rather than glyphosate itself. A commercial surfactant would be added to glyphosate when preparing the solution for application, but the surfactant type of choice is methylated seed oil/crop oil concentrate, which is typically a corn oil derivative and not implied in causing endocrine effects. No POEA or NPE based surfactants would be used.

In the review of the mammalian toxicity data on imazapyr, U.S. EPA Office of Pesticide Programs concluded that "there was no evidence of estrogen, androgen and/or thyroid agonistic or antagonistic activity shown." SERA found that this conclusion was reasonable, based on their review of current information in the 2011 imazapyr risk assessment.

For imazapic, available toxicity studies have not reported any histopathologic changes in endocrine tissues that have been examined as part of the standard battery of tests. Extensive data are available on the reproductive performance and development of experimental animals exposed to imazapic indicates that effects occur at doses higher than that for effects to skeletal muscles. The RfD is based on the effect to muscles and should be protective of endocrine effects; HQ's for Imazapic are orders of magnitude below 1 and do not indicate any risk.

For picloram, a two-generation reproduction study in CD rats reported no endocrine effects at doses as high as 1000 mg/kg/day (SERA 2003). Endocrine effect endpoints examined in this study included reproductive outcomes, histopathological examination of tissues. Other studies reviewed in this risk assessment found no evidence for picloram producing direct effects on the endocrine system.

Sulfometuron methyl appears to have the potential to produce changes in thyroid function at 100 mg/kg/day (SERA 2004). No adverse effects on reproductive parameters were observed in rats exposed to dietary sulfometuron methyl at dietary concentrations up to 5000 ppm (Wood et al. 1980). The acute and chronic RfDs for sulfometuron methyl are 0.87 mg/kg for a decrease in maternal and fetal weight gain and 0.02 mg/kg for effects to blood parameters, respectively. The very low RfDs should encompass risks to thyroid function. Using those RfDs, all HQ's for sulfometuron methyl were well below 1.0, and often orders of magnitude below 1. Considering available data and analysis results, there is no indication of a risk of endocrine effects from proposed use of sulfometuron methyl.

Triclopyr has not undergone evaluation for its potential to interact or interfere with the estrogen, androgen, or thyroid hormone systems (i.e., assessments on hormone availability, hormone receptor binding, or post-receptor processing). However, extensive testing in experimental animals provides reasonably strong evidence that triclopyr is not an endocrine disruptor. No epidemiological studies of health outcomes of triclopyr have been reported, and there is no clinical case literature on human triclopyr intoxication. Several long-term experimental studies in dogs, rats, and mice have examined the effects of exposure to triclopyr on endocrine organ morphology, reproductive organ morphology, and reproductive function; treatment-related effects on these endpoints were not observed.

While the potential for the proposed herbicides to cause endocrine disruption effects is a current data gap, the potential for these effects are to actually occur are greatly reduced by measures such as required use of proper protective equipment, public notification, use of licensed applicators, limiting application rates and other relevant MR/MM.

Environmental Justice and Disproportionate Effects

The R6 2005 FEIS noted that people of Hispanic/Latino descent and American Indians may be disproportionately exposed to herbicides because they are more likely to be forestry workers (herbicide applicators) than other groups. On the MBS, invasive plant treatments on the Forest are implemented in partnership with the local counties. Crews generally live in the communities in and around the Forest and are not associated with any discrete minority or low-income population. Herbicide treatment applicators are well trained in safe herbicide handling and transportation practices. The worker health analysis above applies to any herbicide applicator.

Effects to minority groups (such as American Indians) who or gather or use plants, animals or are the same as those evaluated above for public herbicide exposure. People gather special forest products such as blackberries, huckleberries, salal, mushrooms, ferns, bear grass, and herbs for personal use and commercial sale. Special forest product harvesters may have more contact with contaminated vegetation than the general public. An unpublished study of commercial permit holders on Pacific Northwest Forests reported that the largest ethnic groups involved with forest product gathering were Hispanics, and Southeast Asians. However, these groups are unlikely to be more affected by herbicide exposure than the results provided for the general public, given the assumptions in the public health analysis. Chronic exposures to some of the herbicides proposed for use exceeded a threshold of concern, but with the exception of triclopyr, HQ values were less than 1 for all but unlikely upper estimates (which are not realistic even for people who spend the most time gathering forest projects). Posting of treatment sites, especially if triclopyr is used, would be especially important in areas of special forest product or berry gathering.

Multiple Chemical Sensitivity

The following information was adapted from USDA 2012, Gypsy Moth Management in the United States, a Cooperative Approach.

Some people feel that they suffer from Multiple Chemical Sensitivity (MCS), which is sometimes referred to as Idiopathic Environmental Intolerances (IEI). In general, individuals with MCS report that they experience a variety of adverse effects as a result of very low levels of exposure to chemicals (including herbicides) that are generally tolerated by individuals who do not have MCS.

Forest Service risk assessments incorporate an uncertainty factor of 10 to account for sensitive individuals, which may or may not eliminate risk that an individual may suffer symptoms. However, the uncertainty factor for sensitive individuals addresses variability in tolerances within a normal population. Individuals reporting MCS assert, either explicitly or implicitly, that they are atypically sensitive. There is no current consensus on the diagnosis and cause of MCS.

Until the etiology and pathogenesis of MCS has been clarified, an organic cause of the MCS-associated symptoms and symptom complexes cannot be entirely ruled out. The Forest Service has no way to resolve concerns for MCS at the project level.

3.3.3.3 Direct and Indirect Effects of the Alternatives

Alternative 1 – No Action

Human health risks are very low for Alternative 1 given the small scale of treatment proposed, the limited suite of herbicides that are approved, the limitations on herbicide application methods and the MR/MM associated with the currently approved project. The MR/MM that serve to reduce risk of harmful herbicide/surfactant exposure to people include:

6. No broadcast spraying (aerial or boom) will occur.

7. Any preparation, transport, or application of herbicide will be done by trained workers with a current Washington State pesticide applicators license.

8. Only the aquatic formulation of glyphosate will be used.

9. If needed, the only surfactant that will be used is Agri-Dex®.

10. Pretreatment briefings will be conducted with all herbicide applicators to emphasize safety requirements.

11. Materials Safety Data Sheets, and Forest Service Information covering glyphosate and Agri-Dex® must be carried in each vehicle at all treatment times, and made available to interested members of the public, on-site.

12. Glyphosate and Agri-Dex® containers must be secured and prevented from tipping during transport.

13. Workers will carry only enough herbicide daily to cover the proposed treatment for that day.

14. Mix only the amount of solution needed to complete daily treatments.

15. Workers will follow all herbicide label guidelines.

16. Containment mats will be used during mixing, to further avoid the risk of a spill.

18. When glyphosate (with Agri-Dex®) is administered via wand-backpack spray, hand wiped, or painted on cut stems, the applicator will use the lowest effective rate.

21. No applications using wand-backpack spray will occur when wind speed exceeds five miles per hour, to lessen drift, or when precipitation is expected within 24 hours.

24. Herbicide mixture (aquatic formulation of glyphosate with or without Agri-Dex®) will be colored with a bright, non-toxic vegetable dye before application.

38. For any site where recreation use/activity is high and invasive plants are located other than along the peripheral….treatment will occur only during the week…Sites will be signed and flagged.

These measures minimize or eliminate human health risks. Workers and the general public are unlikely to be exposed to herbicides above a threshold of concern. Drinking water would not be adversely affected. No triclopyr would be used.

Alternative 2 – Proposed Action

Human health risks are low for Alternative 2. Although a greater variety of herbicides may be used and broadcast spraying is proposed, human health risks are minimal due to the type of herbicides proposed for use, the MR/MMs associated with treatment and the fact that HQ values greater than 1 are limited to upper worst case estimates and unlikely exposure scenarios. The use of aminopyralid is not associated with an HQ greater than 1, even for extreme or accidental exposure scenarios.

Triclopyr is associated with the greatest risks to workers and the public, and is the only herbicide where “central” estimates indicate hazard quotients greater than 1. Triclopyr is currently the first choice herbicide for about 15 acres in Alternative 2. This indicates that triclopyr is less likely to be used than many of the other herbicides proposed. Over time, additional acres may be treated using triclopyr, however MR/MM would minimize risk of harmful exposure. The MR/MM that reduce risk of any harmful herbicide/surfactant exposure to people include:

1. Coordinate herbicide use within 1000 feet (slope distance) of known water intakes with the water user or manager.

2. Coordinate herbicide use with Municipal Water boards. Herbicide use or application method may be excluded or limited in some areas.

3. Pretreatment briefings will be conducted with all herbicide applicators to emphasize safety requirements.

4. Lowest effective herbicide use rates would be used for each treatment situation. Nonylphenol ethoxylate-based non-ionic (NPE) and POEA surfactants would not be used.

6. Herbicide mixture will be colored with a bright, non-toxic vegetable dye before application.

7. Do not apply herbicides when local weather forecast calls for a ≥ 80% chance of rain. Do not broadcast spray when wind speed at the site is in excess of 5 mph. Weather conditions would be monitored periodically during operations.

8. An Herbicide Transportation and Handling Safety/Spill Response Plan would be the responsibility of the herbicide applicator.

23. POEA surfactant would not be used.

29. Herbicide use buffers have been established for perennial and wet intermittent steams; dry streams; and lakes and wetlands. See Table 10.

45. Administrative Sites: Notify Forest employees of upcoming herbicide treatment in advance through e-mail. At the site, post specific treatment methods, herbicide ingredients to be used, and precise treatment location 1 day prior to treatment. Posting to remain on site for 1 week following treatment.

46. Recreation Residence Permit Holders: Notify permit holders of upcoming herbicide treatment in advance through the mail. At the entrance to the recreation residential area, post specific treatment methods, herbicide ingredients to be used, and precise location 1 day prior to treatment. Posting to remain on site for 1 week following treatment.

47. Campgrounds: Provide information about upcoming herbicide treatment in advance through the campground reservation system. At the campground, post specific treatment methods, herbicide ingredients to be used, and precise location 1 day prior to treatment. Posting to remain on site for 1 week following treatment. To the extent possible, treat campgrounds early part of the work week.

48. Trailheads, Picnic Areas and Viewpoints: Alert the public about upcoming herbicide treatments on the Forest website. At the picnic area, viewpoint or trailhead, post specific treatment methods, herbicide ingredients to be used, and precise location at the time of treatment. Posting to remain on site for 1 week following treatment.

49. Boat Launches not associated with picnic areas or campgrounds: Alert the public about upcoming herbicide treatments on the Forest website. At the boat launch, post specific treatment methods, herbicide ingredients to be used, and precise location at the time of treatment. Posting to remain on site for 1 week following treatment.

50. Other treatment areas not listed (including wilderness): Alert the public about upcoming herbicide treatments on the Forest website. At logical locations (for instance, on roadside entry points to treatment areas) post specific treatment methods, herbicide ingredients to be used, and precise location at the time of treatment.

51. Triclopyr would not be applied to edible target plants (berries) when fruit are present.

These measures, along with other MR/MM, Forest Plan standards and Forest Service pesticide use policy, minimize potential for worker and public exposure and risks would not be substantially increased over the No-Action Alternative.

The addition of aminopyralid would likely be a positive factor relative to human health. Aminopyralid is not associated with any worker or public exposures over the threshold of concern (for aminopyralid, all calculated HQ values, even for upper estimates and maximum rates, are below 1). Use of aminopyralid could reduce the potential for human health effects compared to the other alternatives, especially where it could be effective as an alternative to triclopyr.

Alternative 3

Human health risks for Alternative 3 are similar to Alternative 2, except that more acreage would likely be treated with triclopyr in lieu of aminopyralid. Triclopyr is the first choice herbicide for about 153 acres in Alternative 3. The MR/MM in this alternative are the same as for Alternative 2 and are likely to effectively mitigate for the few exposure scenarios that are over a threshold of concern for workers and the general public.

Table 28 compares the potential impacts to worker and public health from herbicide use proposed in the alternatives.

Table 28. Summary Table for Effects Related to Human Health and Herbicide Use

Issue	Alternative 1	Alternative 2	Alternative 3
Impact to Worker Health	No worker health concerns associated with use of herbicides in this alternative.	The only herbicide that resulted in HQ values that exceed 1 is triclopyr. Triclopyr is the first choice herbicide for about 15 acres in this alternative. MR/MM would mitigate for worker exposure to this herbicide.	The only herbicide that resulted in HQ values that exceed 1 is triclopyr. Workers may be exposed to more triclopyr in this alternative because it is the first choice herbicide for 153 acres. MR/MM would mitigate for worker exposure to this herbicide.
Impact to Public Health	Given the type and extent of herbicide use, and the MR/MM associated with this project, no harmful exposures are likely.	Triclopyr is the only herbicide with HQ values greater than 1 at central estimates. However, given the type and extent of herbicide use, and the MR/MM associated with this project, no harmful exposures are likely. Aminopyralid is not associated with any harmful exposure scenarios and is the first choice for the majority of target species.	Triclopyr is the only herbicide with HQ values greater than 1 at central estimates. However, given the type and extent of herbicide use, and the MR/MM associated with this project, no harmful exposures are likely. This alternative would use more triclopyr than the other alternatives.

3.3.3.4 Cumulative Effects of All Alternatives

Workers and the public may be exposed to the herbicides used to treat invasive plants under all alternatives in this project. Cumulative doses are possible within the context of this project, or when combined with herbicide use on adjacent lands or home use by a worker or member of the general public. However, the risk is very small that a person would receive additive exposures during the time period in which the herbicide remained in their body.

The MR/MM, herbicide use buffers, and project caps for the action alternatives would apply to any herbicide use on the Forest, whether as a stand-alone project or in conjunction with other land uses (for instance treatment along a road intended to be used for a vegetation management project). The SERA Risk Assessments evaluated chronic exposure scenarios that would involve the public, including repeated drinking of contaminated water, repeated consumption of contaminated berries, and repeated consumption of contaminated fish.

The potential for cumulative human health effects from any herbicide use proposed in this EIS, combined with other potential herbicide applications in the analysis area, would be encompassed in the health risks estimated for chronic exposure scenarios. These herbicides do not bio-accumulate in people and are rapidly eliminated from the body. Chronic (daily over 90-days) worker exposure was considered in SERA Risk Assessments and did not result in HQ values greater than 1 for any “central” estimate.

A person could be exposed to herbicides by more than one scenario; for instance, a person handling, and then consuming sprayed berries. The cumulative impact of such cases may be quantitatively characterized by adding the HQs for each exposure scenario. A MR/MM would restrict the use of triclopyr, the first choice herbicide for woody vegetation such as berries, to times when fruit is not present. Thus, this type of additive exposure is not likely.

Chapter 3.1.6 describes the ongoing use of herbicides and other methods to treat invasive plants by other federal, state, and county agencies adjacent to the MBS. Of the known herbicide use on adjacent lands, some may pose greater risk to workers or the public than the herbicide use proposed for this project, especially on State Highways. However, the potential contribution to cumulative pesticide use by any alternative is not significant. The small and scattered nature of the infestations make it unlikely that exposures exceeding a level of concern would occur from simultaneous herbicide treatments on Forest Service and other lands.

As noted previously, chronic exposure to triclopyr by workers is a concern. Triclopyr has been reportedly used by Mount Rainier National Park, Washington State Department of Natural Resources, Bonneville Power Administration, Washington State Parks, Washington State Department of Transportation, and King County. The MR/MM for this project minimize the potential for harmful exposures, however workers who may be applying triclopyr elsewhere are advised to limit their exposure (reduce hours of application per day or number of days in a row that this herbicide is used).

The R6 2005 FEIS considered the potential for synergistic effects of exposure to two or more chemicals: “Combinations of chemicals in low doses (less than one tenth of RfD) have rarely demonstrated synergistic effects. Review of the scientific literature on toxicological effects and toxicological interactions of agricultural chemicals indicate that exposure to a mixture of pesticides is more likely to lead to additive rather than synergistic effects (ATSDR, 2004; U.S.EPA/ORD, 2000). Based on the limited data available on chemical combinations involving the twelve herbicides considered in this EIS, it is possible, but unlikely, that synergistic effects could occur as a result of exposure to the herbicides considered in this analysis. Synergistic or additive effects, if any, are expected to be insignificant.”(R6 2005 FEIS p. 4-3).

Workers may be exposed to typical hazards from working in the woods from all treatment methods, especially those using chain saws and other motorized tools. Accidents are correlated with hours worked.

3.3.4 Consistency with Regulations, Policies and Plans

All alternatives comply with standards, policies, and laws aimed at protecting worker safety and public health. This project would not result in disproportionate impacts to low income or minority groups.

3.4 Botany

3.4.1 Introduction

The MBS contains a wide variety of plant species and plant communities including a vast network of riparian areas and wetlands, ranging from deeply shaded old-growth forests in the Western Hemlock Zone, to open meadows in the subalpine Parkland Zone (Henderson et al. 1992). The 51 Treatment Analysis Areas (TAA) include a wide range of natural communities; however, most of the infested acres occur in highly disturbed areas such as road shoulders. Invasive plant sites and botanical species of conservation concern may occur in the same vicinity; however invasive plants are not likely to overlap occupied habitat for botanical species of conservation concern. Invasive plants are centered along roads, quarries, or other highly disturbed sites that are less likely to contain botanical species of conservation concern.

The following section focuses on the risks of using aminopyralid (especially using the broadcast application method) near botanical species of conservation concern, since this information has not been considered in previous documents such as the R6 2005 FEIS and the MBS 2005 DN. This chapter also discusses the character and effectiveness of Management Requirements and Mitigation Measures (MR/MM) intended to minimize or eliminate risk to botanical species of conservation.

Many laws, regulations and policies provide management direction for protection of botanical species of conservation concern. The 1990 MBS Forest Plan, the 1991 M.O.U. between Region 6 and the Washington State Department of Agriculture for the management of invasive plants (RCW 17.10), the 1994 Northwest Forest Plan, the R6 2005 ROD, and the MBS 2005 DN all provide vegetation management direction specific to this project.

Potential conflicts between invasive plant treatments and botanical species of conservation concern were determined through a Geographical Information System (GIS) analysis. Botanical species of conservation concern were identified and overlain with known infestations. Known sites for botanical species of conservation concern are based on field surveys that are assumed to have been conducted in suitable habitats where ground disturbing projects have been proposed. . The surveys are documented in the US Forest Service Natural Resource Inventory System (NRIS) database. Surveys for are generally not conducted within road prisms (including cut and fill slopes) because suitable rare plant habitat is not present in these areas.

This EIS herby incorporates by reference the Botany Specialist Report (40 CFR 1502.21). The Botany Specialist Report is located in the Project Record and contains the detailed data, tables, maps, Affected Environment, analysis, references, reports, and technical documentation supporting the conclusions in this section of the EIS.

3.4.2 Affected Environment

Eleven invasive plant target species pose the greatest threat to native plant habitats of concern on the MBS (see Table 29 below).

Table 29. Invasive Plants that Pose the Greatest Threat to Native Plant Habitats of Concern

Common Name	Native Plant Habitat of Concern
Bittersweet nightshade	Riparian areas/wetlands
Butterfly bush	Riparian areas/wetlands
English holly	Lower elevation deciduous/coniferous forest, including old-growth forests
English ivy	Lower elevation deciduous/coniferous forest, including old-growth forests
Hawkweed- Non-native (common, orange, yellow, spotted, smooth)	Mid-montane to subalpine meadows
Herb Robert	Lower elevation deciduous/coniferous forest, including old-growth forests
Knotweed (Bohemian, giant, Japanese)	Riparian areas/wetlands
Spotted knapweed	Mid-montane to subalpine meadows
Sulphur cinquefoil	Mid-montane to subalpine meadows, talus slopes
Tansy ragwort	Mid-montane meadows
Yellow archangel	Lower elevation deciduous/coniferous forest, including old-growth forests

Currently, surveys for 56 botanical species of conservation concern are conducted whenever suitable habitat is suspected and habitat disturbing management projects are proposed. Protection is required for 302 species if they are discovered, even though most are not targeted for surveys. No botanical species are federally listed as threatened, endangered or proposed for listing.

Forest Service Sensitive Plants include vascular plants, bryophytes, lichens, and fungi on the December 2011 Regional Forester's Sensitive Species List. Survey and Manage plants (hereafter referred to as S&M plants) include vascular plants, bryophytes, lichens, and fungi in the 2001 Record of Decision for Amendments to the Survey and Manage, Protection Buffer and other Mitigation Measures Standards and Guidelines. Two botanical species of conservation concern have been identified by Washington state: boreal jewelweed (*Impatiens noli-tangere)*, is listed as Threatened, and yellow sedge (*Carex flava*), is listed as Sensitive by the Washington Natural Heritage Program. In addition, one additional S&M species not on the 2001 list but on the 2003 and 2011 S&M species lists) is discussed: *Nephroma bellum.* Information about botanical species that do not overlap with TAAs can be found in the Botany Specialist Report and Biological Evaluation. The report also includes lists of botanical species of conservation concern that may occur, but have not been documented on the MBS.

Table 30 displays the botanical species of conservation concern within TAAs.

Table 30. Botanical Species of Conservation Concern Within 30 feet of Invasive Plant Treatment Analysis Areas

TAA #	Sensitive or S&M Plant Scientific Name, Plant Code, Listing Status and NRIS ID	Rare Plant Site Name	Weed Common Name, Plant Family, NRIS ID
2	*Pseudocyphellaria rainierensis*. PSRA3. S&M category A (manage all known sites). NRIS # 6050500359.	Upper White Thin Unit 14	Canada thistle. Asteraceae. NRIS # 6050500262
2	*Peltigera pacifica*. PEPA48. S&M category E (manage all known sites). NRIS # 6050500372	Upper White Thin Unit 28	Bull thistle. Asteraceae. NRIS # 06050500330
2	*Peltigera pacifica*. PEPA48. S&M category E (manage	Upper White Thin	Bull thistle. Asteraceae.

TAA #	Sensitive or S&M Plant Scientific Name, Plant Code, Listing Status and NRIS ID	Rare Plant Site Name	Weed Common Name, Plant Family, NRIS ID
	all known sites). NRIS # 6050500376	Unit 34	NRIS # 06050500346
11	*Galium kamtschaticum*. GAKA. S&M category A (manage all known sites) south of Snoqualmie Pass only[24]. NRIS # 6050500005	Denny Creek Rec. Residence #4	Yellow archangel. Lamiaceae. NRIS # 05-TF-023
11	*Galium kamtschaticum*. GAKA. S&M category A (manage all known sites) south of Snoqulmie Pass only. NRIS # 6050500302	Denny Creek Road	Dalmation toadflax. Scrophulariaceae. NRIS # 05-LP-083
16	*Peltigera pacifica PEPA48*. S&M category E (manage all known sites). NRIS # 6050600050	Eagle Ck	Herb Robert. Geraniaceae. NRIS # 6050600059
16	*Nephroma bellum*. NEBE60. S&M category E (manage all known sites). NRIS # 6050600051	Eagle Ck	Herb Robert. Geraniaceae. NRIS # 06-KW-012
16	*Nephroma bellum*. NEBE60. Concern. NRIS # 6050600054	Eagle Ck	Herb Robert. Geraniaceae. NRIS # 06-KW-012
16	*Nephroma bellum*. NEBE60. Concern. NRIS # 6050600106	Beckler Thin Unit #51	Tansy ragwort. Asteraceae. NRIS # 06-KW-011
16	*Nephroma bellum*. NEBE60. Concern. NRIS # 6050600106	Beckler Thin Unit #51	Herb Robert. Geraniaceae. NRIS # 6050600162
16	*Platanthera orbiculata var. orbiculata*. PLOR4. S&M category C (manage high priority sites). NRIS # USFS0600-EO-00543-50200055	Beckler Thin Unit 51	Bull thistle. Asteraceae. NRIS # 6050600165
19	*Platanthera orbiculata var. orbiculata.* PLOR4. S&M category C (manage high priority sites). NRIS # USFS0600-EO-27197_1816500	Trouble-some Ck Camp-ground	Common hawkweed. Asteraceae. NRIS # 06-KW-008.
23	*Fritillaria camschatcensis*. FRCA5. Sensitive. NRIS # 6050200006	Beaver Creek	Orange hawkweed. Asteraceae. NRIS # 02-LP-004.
23	*Fritillaria camschatcensis*. FRCA5. Sensitive. NRIS # 6050200174	Big Four	Orange hawkweed. Asteraceae. NRIS # 02-LP-004.
23	*Fritillaria camschatcensis*. FRCA5. Sensitive. NRIS # 6050200174	Big Four	Orange hawkweed. Asteraceae. NRIS # 6050200045
23	*Fritillaria camschatcensis*. FRCA5. Sensitive. NRIS # 6050200174	Big Four	Common hawkweed. Asteraceae. NRIS # 6050200051
34	*Carex magellanica*. CAMA7. WA-Sensitive. NRIS # 6050100076	Cumberland Pass	Meadow hawkweed. Asteraceae. NRIS # 10-AR-079.

[24] GAKA is in S&M category A (manage all known sites) south of Snoqualmie Pass (i.e. Interstate 90). The Denny Creek site is more or less at the I-90 dividing line, and could be genetically important because it is the almost the southernmost population in the range of the species.

TAA #	Sensitive or S&M Plant Scientific Name, Plant Code, Listing Status and NRIS ID	Rare Plant Site Name	Weed Common Name, Plant Family, NRIS ID
34	*Carex magellanica*. CAMA7. WA-Sensitive. NRIS # 6050100242.	Cumberland Pass	Meadow hawkweed. Asteraceae. NRIS # 10-AR-079.
38	*Hypogymnia duplicata*. HYDU. S&M category A (manage high priority sites). NRIS # 060501EO_ECOPLOT0605-33021	0605-33021	Herb Robert. Geraneaceae. NRIS # 01-AR-080.
43	*Platanthera orbiculata var. orbiculata*. PLOR4. S&M category C (manage high priority sites). NRIS # 6050100030	Baker Lake Rd	Canada thistle. Asteraceae. NRIS # 01-JA-006.
43	*Carex flava*. CAFL4. Concern. NRIS # 6050100085 and # 6050100134	Near Baker River Inlet into Baker Lake	Reed canarygrass. Poaceae. NRIS # 01-LP-027
44	*Gentiana glauca*. GEGL. R6 Sensitive. NRIS # 6050100100	Skyline Divide	Canada thistle. Asteraceae. NRIS # 01-AR-011.
45	*Cetrelia cetrarioides*. CECE4. S&M category E (manage all known sites). NRIS # 6050100049	North Fork Nooksack River, stream gage	Bohemian knotweed. Polygonaceae. NRIS # 01-AR-065.
45	*Cetrelia cetrarioides*. CECE4. S&M category E (manage all known sites). NRIS # 6050100073	North Fork Nooksack, across from Douglas fir CG	Herb Robert. Geranicaceae. NRIS # 01-AR-001.
45	*Cetrelia cetrarioides*. CECE4. S&M category E (manage all known sites). NRIS # 6050100073	North Fork Nooksack, across from Douglas fir CG	Tansy ragwort. Asteraceae. NRIS # 01-LP-001.
45	*Impatiens noli-tangere*. IMNO. Concern. NRIS # 6050100144	Glacier Public Service Center	Japanese sweet coltsfoot. Asteraceae. NRIS # 01-AR-055.
45	*Impatiens noli-tangere*. IMNO. Concern. NRIS # 6050100144	Glacier Public Service Center	Herb Robert. Geraniaceae. NRIS # 01-AR-056.

3.4.3 Environmental Consequences

All invasive plant treatment methods have the potential to damage individual non-target plants. Manual, cultural and use of biological control agents pose the least risk of adverse effects to non-target vegetation. Mechanical treatment poses slightly more risk to non-target plants than manual. Herbicide risk depends on the herbicide used, application method and distance from non-target plants.

In this project, the differences between alternatives regarding risk from invasive plant treatment to non-target plants are not significant. While some non-target vegetation may be damaged, removed or killed due to invasive plant treatments in all alternatives, the MR/MM associated with the project would minimize the extent, magnitude, and duration of these impacts. Thus, none of the alternatives would cause loss of viability or cause a significant trend toward listing for any botanical species.

The risk to native plant communities from competition from invasive plants is greater than the risk of treatment. The net effect of all alternatives would be positive due to the removal of invasive plants that threaten native vegetation. Alternative 1 is the least cost-effective alternative (see Chapter 3.2). This means that the threats to native vegetation from invasive plants are greatest in this alternative. The more quickly invasive plants can be controlled, the better the chances for long-term survival and viability of native plant communities, including botanical species of conservation concern.

Alternatives 2 and 3 allow for a greater variety of herbicides to be used and include the broadcast method of application. Broadcast spray poses the greatest risk to non-target plants compared to other treatment methods because the area affected tends to be larger and there is greater potential for overspray and drift than spot or hand treatments. In Alternatives 2 and 3, broadcast spraying is proposed within TAAs # 2, 11, 15, 19, 23, 34 and 38 where botanical species of conservation concern have been found.

The differences in potential effects are most important in three treatment analysis areas where hawkweed grows close to botanical species of conservation concern. In TAA 19, common hawkweed grows in close proximity to *Platanthera orbiculata var orbiculata* (Orchidaceae family). Alternative 2 would be more effective and less risky than Alternatives 1 or 3 because the use of aminopyralid is effective on hawkweed but does not affect members of the Orchidaceae family. Alternatives 1 and 3 allow fewer options for effective treatment, especially within close proximity to water. Glyphosate is non-selective and thus poses some risk to this species in Alternatives 1 and 3. In TAA 23, hawkweed grows near four *Fritillaria camschatcensis* (Lilliaceae family) sites. Alternative 2 would be more effective and less risky than Alternatives 1 or 3 because the use of aminopyralid is effective on hawkweed but does not affect members of the Lilliaceae family. Alternatives 1 and 3 allow fewer options for effective treatment, especially within close proximity to water. Glyphosate is non-selective and thus poses some risk to this species in Alternatives 1 and 3.

In TAA 34, hawkweed grows near *Carex magellanica* (Cyperaceae family, grass) in two locations in close proximity to water. Glyphosate is non-selective and thus poses some risk to this species in Alternatives 1 and 3. Aminopyralid is the first year/first choice herbicide for hawkweed under Alternative 2. Aminopyralid does not target grass species, so Alternative 2 would likely pose less risk than the other alternatives.

Site-specific mitigation measures have been developed for botanical species of conservation concern that are within 30 feet of infested areas (Table 31). This is a subset of the locations shown in Table 30, which list botanical species of conservation concern that are in TAAs but are not close to infested sites.

Table 31 lists the MR/MM that would be applied to each of these sites. Botanical species of conservation concern would be protected in all alternatives assuming these measures are followed.

Table 31. Mitigation for botanical species of conservation concern within 30 feet of treatment sites

TAA #	Site Name	Rare plant scientific name and NRIS ID	Invasive plant common name and NRIS ID	Site Specific Prescription
2	Upper White Thin Unit 28	*Peltigera pacifica* (PEPE50) 6050500372	Bull thistle 06050500330	Measures B2 and B4. In addition, log where the PEPE50 grows should be flagged and any thistles within 5 feet of this lichen should be hand pulled.
11	Denny Creek Rec. Residence #4	*Galium kamtschaticum* (GAKA) 6050500005	Yellow archangel 05-TF-023	Measures B2, B4. Because GAKA almost always grows in saturated soils, item B6 applies here. In addition, any yellow archangel within 5 feet of the GAKA should be hand pulled.
16	Eagle Creek	*Peltigera pacifica* (PEPE50) 6050600050	Herb Robert (GERO) 6050600059	Measures B2 and B4. In addition, site where the PEPE50grows should be flagged and any herb Robert within 5 feet of this lichen should be hand pulled.

TAA #	Site Name	Rare plant scientific name and NRIS ID	Invasive plant common name and NRIS ID	Site Specific Prescription
16	Beckler Thin Unit 51	*Nephroma bellum* (NEBE60) 6050600106	Herb Robert 6050600162	Measures B2 and B4. In addition, site where the NEBE60 grows should be flagged and any herb Robert within 5 feet of this lichen should be hand pulled.
23	Beaver creek	*Fritillaria camschatcensis* (FRCA5) 6050200006	Orange hawkweed 02-LP-004	See B2. Under B4, this treatment is acceptable to within 30 feet of the FRCA5 but there is concern about mechanical damage if boom height is lower than FRCA5 height. Also FRCA5 frequently grows in saturated soils (see B6). Flag individual FRCA5 in springtime when they are in flower. Since hawkweed is not effectively controlled by hand-pulling, apply aminopyralid by hand methods within 10 feet of FRCA5. Botanist must be on site during treatments.
23	Big Four	*Fritillaria camschatcensis* (FRCA5) 6050200174	Orange hawkweed 02-LP-004	Same weed site, different rare plant location as previous row. See B2. Under B4, this treatment is acceptable to within 30 feet of the FRCA5 but there is concern about mechanical damage if boom height is lower than FRCA5 height. Also FRCA5 frequently grows in saturated soils (see B6). Flag individual FRCA5 in springtime when they are in flower. Since hawkweed is not effectively controlled by hand- pulling, hand-apply aminopyralid within 10 feet of FRCA5. Botanist must be on site during treatments.
23	Big Four	*Fritillaria camschatcensis* (FRCA5) 6050200174	Orange hawkweed 6050200045	B2. Flag individual FRCA5 in springtime when they are in flower. FRCA5 frequently grows in saturated soils (see B6). Flag individual FRCA5 in springtime when they are in flower. Since hawkweed is not effectively controlled by hand pulling, hand apply aminopyralid within 10 feet of FRCA5. Botanist must be on site during treatments.
23	Big Four	*Fritillaria camschatcensis* (FRCA5) 6050200174	Common hawkweed 6050200051	B2. Under B4, this treatment is acceptable to within 30 feet of the FRCA5 but there is additional concern about mechanical damage if boom height is lower than FRCA5 height. Also FRCA5 frequently grows in saturated soils (see B6). Flag individual FRCA5 in springtime when they are in flower. Since hawkweed is not effectively controlled by hand pulling, hand apply aminopyralid within 10 feet of FRCA5. Botanist must be on site during treatments.
38	Finney Creek bridge	*Hypogymnia duplicata* (HYDU60) 060501EO_ECOPLOT0605-	Herb Robert 01-AR-80	B2. Per B4 – spot spray glyphosate if within 30’ of the HYDU60. Hand-pull all Herb Robert within 5 foot radius of the

TAA #	Site Name	Rare plant scientific name and NRIS ID	Invasive plant common name and NRIS ID	Site Specific Prescription
		33021		Hypogymnia.
43	Baker Lake inlet	*Carex flava* (CAFL4) 0605010008 & 60501001345	Reed canarygrass 01-LP-027	Site specific mitigation is detailed in a stand-alone management and monitoring strategy for CAFL4, Article #510 under Puget Sound Energy Baker River hydroelectric relicensing project.
45	Mt. Baker Highway 542	*Impatiens noli-tangere* (IMNO) 6050100144	Reed canarygrass 01-LP-027	Glyphosate acceptable to within 30' from *IMNO*. Dig all Japanese sweet coltsfoot within 30' of *IMNO* and around plants themselves. Botanist must be on site during treatments.
45	Mt. Baker Highway 542	*Impatiens noli-tangere* (IMNO) 6050100144	Reed canarygrass 01-LP-027	Glyphosate acceptable to within 30' from *IMNO*. Hands pull all herb Robert within 30' of *IMNO* and around plants themselves. Botanist must be on site during treatments.

3.4.3.1 Effects on Non-target Vegetation under EDRR

All alternatives, including No Action, allow for treatment of new invaders. In all alternatives, an individual rare plant may be damaged or die. Effects on non-vascular plants and fungi are particularly uncertain. The potential exists for non-target plants to be inadvertently damaged or killed, especially adjacent to broadcast operations. However, the Management Requirements and Mitigation Measures are intended to provide a high degree of protection for botanical species of conservation concern. The design of the project minimizes the potential for native plants to be adversely affected.

Table 32 displays characteristics of the 10 herbicides proposed for use that have influence on potential impact to rare plants, and which of these may be used in each alternative. Appendix C displays the botanical species of conservation concern likely to be found on the MBS and whether or not the herbicides proposed for use could adversely affect that species.

Table 32. Non-target Plant Considerations for the 10 Herbicides Proposed For Use in Alternative 2

Herbicide	Non-target Plant Considerations	Applicable Alternative
Aminopyralid	Targets Asteraceae, Fabaceae, Polygonaceae, Solanaceae plant families	2
Chlorsulfuron	Protect individual plants from direct spray, drift, runoff, wind erosion	2, 3
Clopyralid	Targets Asteraceae, Fabaceae, Polygonacea, Solanaceae plant families	1, 2, 3
Glyphosate	Non-selective; protect from direct spray; runoff not a concern.	1, 2, 3
Imazapic	Protect from direct spray, drift, runoff & timing after use of other herbicides	2, 3
Imazapyr	Non-selective; protect plants from direct spray, drift, runoff	1, 2, 3
Metsulfuron methyl	Protect individual plants from direct spray, drift, runoff, wind erosion.	1 (Skiyou Island only), 2, 3

Herbicide	Non-target Plant Considerations	Applicable Alternative
Picloram	Targets Asteraceae, Fabaceae, Polygonaceae, Solanaceae plant families. Protect from direct spray drift, runoff. Scrophulariaceae, Brassicacea, and Liliaceae less susceptible. Grasses not affected.	2, 3
Sulfometuron methyl	Non-selective; Protect plants from direct spray, drift, runoff, wind erosion	2, 3
Triclopyr	Effective on woody plants. R6 2005 FEIS limits use of triclopyr to selective application techniques	2, 3

3.4.3.2 Cumulative Effects (All Alternatives)

The following assumptions apply to the Botany Cumulative Effects Analysis:

- Invasive plants will spread at a rate of 4-12 percent over the life of the project. Effective treatment will reduce the acreage subject to spread. Prevention will slow but not stop spread. Some introductions and events are not controllable.
- Agricultural land managers and other neighbors (BLM, Park Service, County and State) are effectively managing invasive plants and helping to prevent their spread to National Forest.
- The spatial extent of the analysis area for cumulative effects on the botanical resources is the 52 Treatment Analysis Areas.
- The temporal extent of cumulative effects on non-target vegetation is the duration of the invasive plant treatment period.
- The treatment period is usually from 1 to 5 years, depending on the site.
- Non-target vegetation could potentially be impacted within a 15-foot radius of spot treatments when a non-selective herbicide is used. Non-target vegetation could potentially be impacted within a 100 foot radius of broadcast treatments when a non-selective herbicide is used. The loss of non-target vegetation from incidental treatment impact is less than displacement (loss) of non-target vegetation from competition from invasive plants.

The more acres of invasive plants treated both on and off National Forest System land, the more non-target plant damage and mortality is possible, especially from broadcast spraying. However, given the MR/MMs and buffers, potential for direct and indirect effects to non-target plants from invasive plant treatments in any alternative is low, even when the potential actions on land of other ownerships are considered. The potential negative effects of past, present and foreseeable future treatments on non-target plants, when combined with the effects of any of the alternatives, would be minor and short term.

In younger forest plantations, developing forest canopy will eventually shade out shade-intolerant species such as tansy ragwort that thrive in full sun. However, without treatment, during the decades it takes for forest shade to recover, invasive plants could continue to spread, often beyond the boundaries of the plantations.

The road system on the MBS has been shrinking over time in conjunction with a decline in funding for maintenance. Closed roads will eventually be decommissioned or revegetate naturally over time, thus reducing their susceptibility to invasive plant infestations. Ongoing and reasonably foreseeable future (Forest Service) actions would be subject to MBS Forest Plan standards guidelines. Currently these standards direct that project impacts be evaluated and described during environmental analysis. Forest Service policy is not to approve projects where the effects to botanical species of conservation concern would create a trend toward federal listing (under the ESA) or cause a loss of population viability.

Recently completed projects on the MBS include closing and restoring roads; road construction, reconstruction and maintenance; vegetation management (mainly thinning); and recreation development and maintenance. These projects occur within treatment analysis areas mapped within the project area (TAA 4, 15, 19, 23, 26, 27, 41, 43, 44, and 45) where invasive plant treatment sites occur within or near the recently completed projects.

Several projects are currently being implemented or are ongoing on the MBS. These include mining; a variety of recreation projects; road repair, closure, reconstruction/improvement, decommissioning and maintenance; stream restoration; and vegetation management (thinning and created openings). Projects are being implemented in TAA 2, 3, 4, 5, 6, 11 15, 16, 17, 20, 23, 27, 30, 32, 33, 36, 41, 43, 45, 47, 49 and 53.

Several projects are planned to be implemented in the foreseeable future. These include recreation and site maintenance; road closure, repair and reconstruction; vegetation management (mainly thinning and some created openings) and stream restoration. The projects overlap invasive plant treatments proposed in TAA 2, 4, 6, 11 14, 19, 23, 32, 33, 38, 32, 43, and 45 and may last for several years.

The recent past, current, ongoing and foreseeable future projects listed in Appendix F were reviewed to determine whether they might have impacts on botanical species of conservation concern that could combine with the impacts of this project. The focus of this analysis is areas that may be broadcast sprayed since this is where the likelihood of drift is greatest. Examples of recent past, on-going or foreseeable projects that overlap areas that may be potentially broadcast sprayed include: TAA # 2 (Upper White River Vegetation and Restoration Project), TAA 11 (Denny Creek Franklin Falls trails and parking lot), TAA 15 (Geothermal Exploration and the Stevens Pass Master Plan Development) TAA 19 (Beckler Thin), TAA 23 (Mountain Loop Scenic Byway Trailhead Enhancements), TAA 34 (Segelsen Ridge Huckleberry Enhancement), and TAA 38 (Finney AMA Timber Project). All of the projects have been or would be designed to protect botanical species of conservation concern. Monitoring has demonstrated that mitigation associated with current and/or completed projects has effectively protected botanical species. Thus, the potential for cumulative effects to botanical species of conservation concern is low to non-existent, and the magnitude of adverse impacts would be minor.

Recreation

The low intensity of the disturbance related to recreation activities and maintenance of recreation sites generally have had limited impact on botanical resources of concern. However, recreation activities can be vectors of invasive plant spread and are likely new areas that will be detected and need to be treated through the life of the project.

The impacts of repeated treatments would not likely accumulate because the MR/MM associated with invasive plant treatment would limit the extent, duration and intensity of impacts. Invasive plant populations would become smaller each treatment entry, so the risk to botanical resources from repeated treatments would tend to decline. The MR/MM along with monitoring and native plant restoration associated with the project would be expected to help reduce the potential for re-infestation over time.

Vegetation Management

Vegetation management can result in light to heavy ground disturbance depending on the type of project. These projects can have both positive and negative effects on non-target vegetation. Botanical species of conservation concern would be protected through design features and layout, reducing the potential for impacts to botanical species of conservation concern. Impacts would be incidental and limited to individual plants rather than populations.

Logging sites have historically been areas where invasive plants have become established, primarily because MR/MM associated with invasive plants was not consistently included in NEPA documents or contract specifications in the 1980s and early 1990s. Since then, prevention measures reduce the potential for these projects to result in the spread of invasive plants. Treatment of invasive plants prior to ground disturbance and other measures (such as washing equipment and using weed free mulch) help limit the potential for spread. Should invasive plants be introduced in vegetation management project areas, the impacts of repeated treatments would not likely accumulate because the MR/MM associated with invasive plant treatment limit the extent, duration and intensity of impacts. The impacts of repeated treatments of currently known infested areas would likely be smaller in extent than initial treatments since invasive plant populations are expected to decline.

Road Repair, Reconstruction and Maintenance

Road repair, reconstruction and maintenance is ongoing and can be a vector for invasive plant spread if equipment picks up invasive plant materials and moves them to non-infested areas. Prevention measures are intended to reduce this risk. Road maintenance can damage desirable non-target plants, however roadside vegetation growth is generally very vigorous and damage to forbs, shrubs and deciduous trees (such as red alder or cottonwood) is short lived. Botanical species of conservation concern are far less likely to occur within the road prisms than other areas. Thus there is low likelihood that road maintenance projects would combine with invasive plant treatments and cause a cumulative impact to rare plants.

Road Closure and Restoration

The initial activities associated with road closure and restoration may be ground disturbing, however prevention measures such as inventorying and treating invasive plants before the roads are closed, washing equipment, and use of weed-free mulch and revegetation with native plants would reduce the risk of introducing invasive plants. Road closure and restoration would reduce the potential for invasive plant spread over time. The likelihood of cumulative impacts to botanical species of conservation concern from invasive plant treatment combined with road closure and restoration is low.

Stream Restoration Projects

As with road closure, the initial activities associated with stream restoration such as building structures or removing culverts may be ground disturbing but prevention measures such as inventorying and treating invasive plants before the project is implemented, washing equipment, and use of weed-free mulch, and revegetation with native plants would reduce the risk of introducing invasive plants.

Land Management Adjacent to the MBS

Of all the types of activities and projects listed above, activities or projects associated with adjacent land management may be the most likely to contribute towards cumulative effects on non-target vegetation. This is because R6/MBS Forest Plan direction and mitigation does not apply to activities outside the Forest. Chapter 3.1.6 describes what is known about herbicide use adjacent to the MBS National Forest boundary. These treatments are unlikely to affect invasive plants within the TAAs but may have impacts on botanical species of conservation concern outside the MBS. The extent of possible effects on botanical species of conservation concern outside the project area is not known.

The MBS coordinates with adjacent land owners to reduce impacts of their actions on invasive plant spread and non-target vegetation. The MBS participates in 7 Cooperative Weed Management Areas (CWMAs) including the Green-Duwamish CWMA, Middle Fork Snoqualmie CWMA, Skagit CWMA, Skykomish CWMA, Stillaguamish CWMA, and Yakima CWMA (which includes Snoqualmie Pass Ski Area and several other areas west of the Cascade crest).

Most populations of botanical species of conservation concern are too distant from National Forest to be affected by actions off the national forest. Drift associated with herbicide treatments near National Forest is possible, and adjacent land owners would not necessarily add as many layers of caution to herbicide use; however, the analysis assumes all herbicide use would conform to label guidance. The risks to non-target vegetation and botanical species of conservation concern from treatments off forest would be outweighed by the benefit of reducing invasive plant populations adjacent to National Forest System lands

3.4.4 Consistency with Regulations, Policies and Plans

All of the alternatives are consistent with the MBS Forest Plan (amended) and other laws and regulations regarding protection of botanical resources. Alternative 1 does not utilize all of the herbicides available for use and thus misses opportunities for more effective treatments. In addition, all alternatives comply with the Northwest Forest Plan, as amended (USDA, USDI 1994). The Survey and Manage mitigation measure from the Northwest Forest Plan has been litigated and modified since 1994. All alternative comply with the most recent Settlement Agreement (April 25, 2013).

3.5 Wildlife

3.5.1 Introduction

The Mt. Baker-Snoqualmie National Forest (MBS) provides diverse habitats, ranging from subalpine forest to wet meadows, and from late-successional temperate rainforest of Douglas-fir, hemlock and cedar to mixed conifer plantations, for a diverse array of wildlife species, including amphibians and reptiles. The MBS is located within the Pacific Flyway, which is a major migratory route for thousands of birds. Many species that are not permanent residents on the Forest may be found here during migration.

The MBS provides important wildlife habitat for one federally listed endangered species and three federally listed threatened species. One candidate species occurs on the Forest.

Invasive plant species have become established on the MBS and continue to spread, which may impact wildlife habitat and pose a risk of injury to wildlife. Methods used to treat invasive plants have the potential to have adverse effects to individual animals as well as wildlife habitat. The following wildlife analysis focuses on potential effects of treatment on terrestrial Species of Local Interest including Survey and Management species; Listed and Proposed Threatened and Endangered Species, Regional Forester Sensitive Species and Management Indicator Species (MIS). Effects on MIS species indicate welfare of other species using the same habitat (Thomas 1979). Birds of Conservation Concern are also discussed.

This EIS herby incorporates by reference the Wildlife Specialist Report (40 CFR 1502.21). The Wildlife Specialist Report is located in the Project Record and contains the detailed data, tables, maps, affected environment, analysis, references, reports, and technical documentation that the project ID Team's Wildlife Biologist relied upon to reach the conclusions in this EIS.

3.5.2 Affected Environment

3.5.2.1 Invasive Plants and Wildlife Habitat

Some wildlife species utilize invasive plants for food or cover. For example, American goldfinch (*Carduelis tristis*), and red-winged blackbird (*Agelaius phoeniceus*) utilize purple loosestrife (Kiviat 1996; Thompson, Stuckey, and Thompson 1987), and native bighorn sheep will utilize cheatgrass (Csuti et al. 2001). It has been reported that elk, deer and rodents eat rosettes and seed heads of spotted knapweed. However, the few uses that an invasive plant may provide do not outweigh the adverse impacts to an entire ecosystem (Zavaleta 2000). More detailed information on the effects of invasive plants to wildlife is reported in the R6 2005 FEIS.

Invasive plants have adversely impacted habitat for native wildlife (Washington Department of Fish and Wildlife 2003). Any species of wildlife that depends upon native understory vegetation for food, shelter, or breeding, is or can be adversely affected by invasive plants. In the case of common burdock (*Arctium minus*), the prickly burs can trap bats and hummingbirds and cause direct mortality to individuals (Raloff 1998, USDI 1999). Species restricted to very specific habitats, for example pond-dwelling amphibians, are more susceptible to adverse effects of invasive plants.

Displacement of native plant communities by non-native plants results in alterations to the structure and function of ecosystems (MacDonald et al. 1989), and constitutes a principal mechanism for loss of biodiversity at regional and global scales (Lacey and Olsen 1991; Risser 1988 as cited in Johnson et al. 1994). Mills et al. (1989) and Germaine et al. (1998) found that native bird species diversity and density, were positively correlated with the volume of native vegetation, but were negatively correlated or uncorrelated with the volume of exotic vegetation. Invasive plants can adversely affect wildlife species by eliminating required habitat components, including surface water (Brotherson and Field 1987; Dudley 2000; Horton 1977), reducing available forage quantity or quality (Bedunah and Carpenter 1989; Rice et al. 1997; Trammell and Butler 1995); reducing preferred cover (Rawinski and Malecki 1984; Thompson et al. 1987); drastically altering habitat composition due to altered fire cycles (D'Antonio and Vitousek 1992; Mack 1981; Randall 1996; Whisenant 1990); and physical injury, such as that caused by long spines or "foxtails" (Archer 2001). Invasive plants that grow large and densely (e.g., giant reed, Himalayan blackberry) can act as physical barriers to water sources and essential habitat (Callaghan 2014).

Invasive plants can act as a population sink by attracting a species and then exposing them to increased mortality or failed reproduction (Chew 1981). For example, Schmidt and Whelan (1999) reported that native birds increased their use of exotic *Lonicera* and *Rhamnus* shrubs over native trees, even though nests built in the exotic shrubs experienced significantly higher mortality rates.

Some invasive plants (such as knapweed) contain chemical compounds that make the plant unpalatable to grazing animals. Chemical compounds in these invasive plants disrupt microbial activity in the rumen, or cause discomfort after being ingested, resulting in a reduced or avoided consumption of the invasive plant (Olson 1999).

Habitats that become dominated by invasive plants are often not used, or used much less, by native and rare wildlife species. Washington Department of Fish and Wildlife (2003) identified noxious weeds as threats to upland game bird habitat. Some hunters and wildlife managers are concerned that invasive plants are degrading the quality of remaining habitat for deer and elk and are adversely affecting the animal's distribution and hunting opportunities. Trammell and Butler (1995) found that deer, elk, and bison avoided sites infested with leafy spurge (*Euphorbia esula*). Tamarisk stands have fewer and less diverse populations of mammals, reptiles, and amphibians (Jakle and Gatz 1985; Olson 1999). Invasion by purple loosestrife makes habitat unsuitable for numerous birds, reptiles and mammals (Kiviat 1996; Lor 1999; Rawinski 1984; Thompson, Stuckey, and Thompson 1987; Weihe and Neely 1997; Weiher et al. 1996). Reed canarygrass has been implicated in the loss of Oregon spotted frog habitat may have contributed to contractions in the range of the Oregon spotted frogs in western Oregon (Hayes 1997, McAllister and Leonard 1997, Watson 2003).

Of the federally listed and other species of concern that occur on the MBS, none are known to be adversely affected by invasive plants within the project area. Bald eagle mortality in other parts of the

U.S. has been linked to a toxin produced by a cyanobacterium that grows on the invasive aquatic plant, *Hydrilla verticillata* (Wilde 2005).

Some invasive species could adversely affect bald eagle foraging areas by creating dense patches of tall vegetation in and around streams or rivers that could hinder access to salmon. This speculation is based on observations of some invasive species that grow along rivers and streams in Region 6.

In summary, invasive plants are known or suspected of causing the following effects to wildlife:

- Embedded seeds in animal body parts (e.g. foxtails), or entrapment (e.g. common burdock) leading to injury or death
- Scratches leading to infection
- Alteration of habitat structure leading to habitat loss or increased chance of predation
- Change to effective population through nutritional deficiencies or direct physical mortality
- Poisoning due to direct or indirect ingestion of toxic compounds found on or in invasive plants
- Altered food web, perhaps due to altered nutrient cycling
- Source-sink population demography, with more demographic sinks than sources
- Lack of proper forage quantity or nutritional value at critical life periods

3.5.2.2 Threatened, Endangered, Sensitive, and Management Indicator Species

Federally Listed Species

Several species listed as "threatened" under the Endangered Species Act (ESA) of 1973 (as amended) are found on The MBS. In addition, the U.S. Fish and Wildlife Service (USFWS) maintains a list of "candidate" species. Candidate species are those taxa that the USFWS has on file, and includes sufficient information on biological vulnerability and threats to support issuance of a proposal to list, but issuance of a proposed rule is currently precluded by higher priority listing actions (USDI 1996). Listed and candidate species of terrestrial wildlife found on the MBS are included in Table 33.

Table 33. Federally listed and candidate wildlife species on Mt. Baker-Snoqualmie National Forest

Common Name	Scientific Name	Status	Critical Habitat
Birds			
Northern Spotted Owl	*Strix occidentalis caurina*	Threatened	Designated
Marbled Murrelet	*Brachyramphus marmoratus*	Threatened	Designated
Mammals			
Grizzly Bear	*Ursus arctos*	Threatened	None
Gray Wolf	*Canis lupus*	Endangered	None
Wolverine	*Gulo gulo*	Candidate	None

The single candidate species found on the MBS is also included in the Regional Forester's Sensitive Species List and is discussed in the section titled "Forest Service Sensitive Species." Detailed species accounts prepared for the Biological Assessment prepared for the R6 2005 FEIS are incorporated by reference. Information regarding the environmental baseline and critical habitat in the project area for federally listed species can be found in the Programmatic Biological Assessment for Forest Management Mt. Baker -Snoqualmie Terrestrial (USDA Forest Service 2002). This information is incorporated by reference and is summarized below.

Northern Spotted Owl

Detailed accounts of the taxonomy, range, and habitat requirements of northern spotted owls (spotted owl) may be found in the 1987 and 1990 Fish and Wildlife Service Status Reviews (USDI 1987, 1990a); the 1989 Status Review Supplement (USDI 1989), and the Interagency Scientific Committee Report (Thomas et al. 1990). Spotted owls were listed as federally threatened in June of 1990 (USDI 1994).

Spotted owl home ranges on the MBS are fairly large and encompass large amounts of late-successional forest. The median home range size is 6,651 acres (1.8 mile radius) and the median amount of old-growth and mature forest within the home range is 3,281 acres (USDI 1992).

The biology of this species is summarized in Thomas et al (1990). Available information suggests that owls on the Forest begin nesting activities in March, when establishment of nest territories begins. Incubation of eggs occurs from March through May, feeding and care of nestlings from May through June, and fledging occurring in June or early July. Juvenile dispersal is expected from September throughout the fall.

For impacts analysis purposes of this EIS, the breeding season for spotted owls is divided into an early season, March 1 through July 15, and a late season, July 16 through September 30. There is ongoing discussion as to whether or not spotted owls are negatively affected from noise disturbance at any point in their breeding cycle. Nest fidelity of owls during incubation of the eggs to when the young fledge is high, with reproductive pairs actively pursuing prey items to feed the young. Adult fidelity to feeding young is noted in the spotted owl survey protocol, and is the basis to determine reproductive success.

If susceptible to noise disturbance, spotted owls are more likely to be disturbed during the early breeding season, when adults are producing and incubating eggs up to when the young become strong fliers. Once young owls become strong fliers they are unlikely to be adversely disturbed by noise. Therefore, spotted owls are less likely to be susceptible to noise disturbance during the late breeding season (July 16 to September 30).

Detailed accounts of the habitat requirements of the northern spotted owl may be found in the 1987, 1989, and 1990 Fish and Wildlife Service Status Reviews (USDI 1987, 1989, 1990b) and the Interagency Scientific Report (Thomas et al. 1990). The northern spotted owl is a predatory species feeding primarily on forest-dwelling mammals. The primary spotted owl prey species in Washington State is the northern flying squirrel (*Glaucomys sabrinus*). Additionally, prey species include a number of arboreal and terrestrial mammals associated with mature and over-mature forest stands.

Suitable habitat for the northern spotted owl must provide for the nesting, roosting, and foraging needs of the bird as well as for dispersal. Suitable habitat is characterized by moderate to high canopy closure (60-80 percent); a multi-layered, multi-species canopy with large (greater than 30 inches d.b.h.) overstory trees; a high incidence of large trees with various deformities, cavities, broken tops, mistletoe infections and other evidence of decay; large snags; large accumulations of fallen trees and other woody debris on the ground, and sufficient open space below the canopy for the owls to fly (Thomas et al. 1990).

In the western Washington Cascade Mountains, spotted owls used mature, older forests dominated by trees greater than 20 inches d.b.h. with greater than 60 percent canopy closure, more often than expected for roosting during the non-breeding season. Spotted owls used young-forest trees 8 inches to 20 inches d.b.h. with more than 60 percent canopy closure, less often than expected based on availability (Herter et al. 2002).

On the MBS, northern spotted owls use mature and old-growth forest habitat within the western hemlock and Pacific silver fir vegetation zones. Habitat includes old-growth forest stands for nesting and foraging, mid- to late-seral stands for foraging, and immature to old-growth stands for dispersal. A review of spotted owl pairs with the highest reproductive success on the Forest found that the higher reproductive pairs occur mostly in the western hemlock/sword fern Plant Association Groups (PAGs)($p<0.01$, Iverson Unpublished data). The total number of spotted owls occurring on the Forest is unknown, since all suitable habitat has not been surveyed (less than 55 percent of the habitat as of 1995), and the majority of surveys which have been conducted occurred prior to 1994. There is approximately 482,550 acres of suitable spotted owl nesting habitat on the Forest.

The Final Revised Recovery Plan for the Northern Spotted Owl (USDI 2011) recommends retaining all occupied and unoccupied, high quality spotted owl habitat on all lands to the maximum extent possible. This plan does not include specific recommendations on a network of management areas for spotted owl habitat, since the U.S. Fish and Wildlife Service (USFWS) is in the process of conducting a rangewide, multi-step modeling process to design, assess, and inform designation of a habitat conservation network that will help address the recovery of the spotted owl.

Northern Spotted Owl Critical Habitat

A Final Rule to designate revised critical habitat for the spotted owl was published in the Federal Register, November 21, 2012 (USDI 2012). Primary constituent elements for owl critical habitat consist of habitat features that support nesting, roosting, foraging, and dispersal.

The MBS has 648,542 acres of designated revised critical habitat comprised of portions from two critical habitat units. The West Cascades North Unit consists of 542,274 acres, which except for 798 acres of State land, is comprised of federal lands managed by the Mt. Baker-Snoqualmie and Wenatchee National Forests. The West Cascades Central Unit consists of 909,687 acres, which except for 825 acres of State land, is comprised of lands managed by the Mt. Baker-Snoqualmie, Gifford Pinchot, and Wenatchee national forests.

The successional stages of forest occurring within the boundaries of the CHUs range from non-habitat (e.g., young plantations) to high-quality habitat (e.g., large blocks of old-growth forest). On the MBS, portions of the critical habitat include forest associations that are not thought to provide suitable habitat (Pacific silver-fir, mountain hemlock, and parkland zones). Many of the proposed invasive plant treatment sites would occur in designated spotted owl critical habitat units. Proposed treatments are located primarily along roads and limited to invasive plants only and would not affect native understory or overstory vegetation that comprises critical habitat.

Marbled Murrelet

The marbled murrelet (murrelet) has been listed as federally threatened since October 1992 (USDI 1994). The murrelet uses inland forest sites for nesting from Alaska to Northern California (Marshall 1988). Detailed accounts of the taxonomy, range and habitat requirements of the marbled murrelet may be found in the 1988 Status Review (Marshall 1988), the Final Rule designating murrelets as threatened (USDI 1992b), the designation of revised critical habitat for the species (USDI 2011), the U.S. Forest Service's general technical report on ecology and conservation of the marbled murrelet (Hamer and Nelson 1995a), and the Recovery Plan for the Marbled Murrelet (USFWS 1997).

Nesting occurs over an extended period from late March to mid-September. Studies in Washington indicate that incubation usually begins by April 26 and extends to July 30. Both sexes incubate the egg for about 30 days, and the nestling period runs from May 26 through August 27. The young fledge at about 30 days of age. Total length of breeding season was 124 days (Hamer and Nelson 1995a). These dates and numbers are approximations based on a small sample size. Adults feed the chicks generally twice a day, most often at dusk and dawn. Other than a 1-3-day brooding period, adults leave the chicks alone on the nest except when actively feeding. A fledgling's first flight is presumed to be from the nest directly to the marine environment (Nelson and Hamer 1995).

The nesting season in Washington was redefined as the period from April 1 to September 23 (USDI 2012). Daily operating restrictions limiting noise generating activities to occur 2 hours after sunrise to 2 hours before sunset are believed to be beneficial in in reducing exposure of nesting murrelets to disturbance during these times. However, due to a proportion of feeding that occurs in the middle of the day, the implementation of this restriction would not completely avoid potential adverse effects to murrelets, eggs, or chicks.

Suitable nesting habitat for the marbled murrelet is considered to be mature to old-growth coniferous stands, or those younger stands with interspersed large trees which may provide nesting opportunities. Generally, the habitat characteristics associated with murrelet nesting are large trees with large lateral branches, mistletoe infection, witches brooms and a mature understory that extends into the canopy. These elements provide nesting substrate, which are associated with trees 200 to 250 years of age. Currently, available nesting habitat on the Forest is estimated at 297,262 acres.

Marbled Murrelet Critical Habitat

A Final Rule to designate revised critical habitat for the marbled murrelet was published in the Federal Register, October 5 2011 (USDI 2011). The MBS contains approximately 783,253 acres of designated revised critical habitat, less than one-half of which is considered suitable murrelet nesting habitat. On the MBS, portions of the critical habitat include forest associations that are not thought to provide suitable habitat (silver-fir, mountain hemlock, and parkland zones). Many of the infested areas occur in designated murrelet critical habitat units. Proposed treatments are located primarily along roads and limited to invasive plants. Native trees and understory vegetation are not likely to be affected.

Grizzly Bear

The North Cascade Grizzly Bear Recovery Zone on the MBS occurs on National Forest System lands north of Interstate 90. The North Cascade Mountains still has a small population of grizzly bear (Servheen 1997). Estimates range from less than 20 to 50 animals (Almack et al. 1993) to fewer than 12 (MacCracken and O'Laughlin 1998).

The last reported kill of a grizzly bear in the North Cascade Mountains occurred in 1967 (Servheen 1997). Since 1983, there have been 2 confirmed and 11 probable grizzly bear detections on the MBS. Despite intensive efforts, less than one confirmed, or probable detections occur per year. A bear photograph, taken in 2010 by a hiker just off the Forest in the North Cascades Park, was confirmed a grizzly bear by biologists. The previous confirmed or probable grizzly bear detection in the North Cascades Recovery Area occurred on the MBS in 1996. There are no known den sites.

Potential habitat in the North Cascades Recovery Area is believed to provide sufficient habitat to support 200 to 400 grizzly bears (Servheen et al. 1991, MacCracken and O'Laughlin 1998). Despite a lack of known mortality, the population does not appear to have grown. The lack of grizzly bear population growth in the absence of known human-caused mortality could indicate that the likelihood of opposite sex encounters is very low, or that genetic problems are limiting cub survival.

The MBS, and other federal land management agencies in the recovery zone, currently maintain options for grizzly bear recovery by following an interim no net loss of core area policy. This interim policy is expected to remain in effect until the recovery area subcommittee adopts a new policy based on a habitat assessment to be completed by the technical team.

Grizzly bears hibernate in the winter and excavate dens in which to hibernate, with the denning season occurring from October 30 to April 30. Grizzlies are omnivorous and opportunistic feeders. They may eat carrion, grasses, riparian forbs, berries, bulbs, insects, whitebark pine nuts, fish, ungulates, ground squirrels, roots, bulbs, fungi, tree cambium, and even garbage (Cole 1972; Hamer 1974; Hamer et al. 1977 as cited in USDI 1993a; Martinka 1972; Murie 1944; Pearson 1975; and Singer 1978). In some areas grizzlies may be almost entirely herbivorous, and they rely on plants that have recently emerged, when crude protein levels are highest (USDI 1993). Foods high in protein and carbohydrates that allow for significant fat deposition prior to hibernation are essential for the grizzly's survival.

The search for food has a prime influence on grizzly bear movements. Upon emergence from the den they seek the lower elevations, drainage bottoms, avalanche chutes, and ungulate winter ranges where their food requirements can be met. From late spring to early summer they follow plant green-up back to the higher elevations. In late summer and fall, the bears will transition to fruits and nuts as a food source.

Gray Wolf

Wolves are habitat generalists (Mladenoff et al. 1995), occurring in all vegetation types except tropical rain forests and arid deserts (Mech 1970). Pelts traded with the Hudson Bay Company indicate that wolves historically occurred at low density in the Puget Sound Region, with higher densities in eastern Washington (Laufer and Jenkins 1989).

Gray wolves are sensitive to human disturbance, particularly around denning and rendezvous sites. Security habitat for this species, defined as all habitat types containing less than 1.0 mile per square mile density of open road, is a measurement indicator for assessing project-level effects. Security habitat is typically evaluated in terms of the relative level of human influence within a fifth-field watershed area (Gaines et al. 2003). Gaines et al. (2003) defined levels of human influence by the following:

- low level = greater than 70 percent of watershed contains security habitat
- moderate level = 50 to 70 percent of watershed contains security habitat
- high level = less than 50 percent of the watershed contains security habitat

Human influence on wolf security habitat varies on the MBS from low levels in wilderness areas to high levels along roads, campgrounds, trails, and other high human use areas. However, to assess impacts to dispersing wolves, the MBS often uses changes in open road density and grizzly core habitat as a proxy for wolf security habitat. Denning season occurs from April 1 to June 30, and use of rendezvous sites occurs until August 31.

Until recently, gray wolves have not existed at population levels capable of breeding in Washington State. Dispersing individuals from populations in Idaho, Montana, and British Columbia have been documented, an occurrence that has become more common since 2005 as these populations have become re-established. In July of 2008, a pack with pups was discovered in western Okanogan and northern Chelan Counties (WDFW 2008). As of 2014, 13 packs have been documented in eastern Washington; with more suspected (WDFW 2014).

A rendezvous site was reported along the Cascade Crest in the Glacier Peak Wilderness in 1991. In the early 1990s, Gaines et al. (1995) reported a lone wolf and one pack responding to simulated wolf howls on the Okanogan-Wenatchee National Forest. In 1990, a wolf pack was reported in the Hozomeen area of the North Cascades National Park. Although Hozomeen is west of the Cascade Crest, it is in the rain shadow of numerous mountains and supports dry forest vegetation similar to east-side forests. Wolf activity in these areas has been transient with no occurrence since the initial detection.

Howling surveys were conducted on the MBS throughout the 1990s. Since the surveys were concentrated in areas where unconfirmed wolf sightings were most common and no responses were detected, it is most likely that the reported wolf sightings were transient wolves. It is important to note that these 1990s surveys occurred when ungulate populations were more than twice the size of current populations (WDFW 2002).

Transient wolves, including packs, have been confirmed in dry forests of the North Cascade Mountains where ungulate populations are relatively high. Despite howling surveys in areas of suspected wolf activity in years when ungulate populations were substantially higher, no wolves have been confirmed west of the Cascade Crest. As a result, there is no indication that resident animals currently occupy the area west of the Cascade Crest. Occasional dispersal may occur from populations on the east side of the Cascade Mountains or from Canada.

With wolves possibly colonizing habitats with higher ungulate abundance east of the Cascade Crest, dispersing wolves may occur on the MBS. That portion of the MBS adjacent to the Cascade Crest and those areas with remnant elk populations may be important for wolf dispersal; facilitating colonization of other suitable areas in eastern Washington. With territorial packs established east of the Cascade Crest, attempts at colonization west of the crest may occur; portions of the MBS may be included in wolf territories. When these conditions develop, additional consultation regarding project effects on gray wolf will be needed.

Forest Service Sensitive Species

Terrestrial wildlife species found or suspected on the MBS that are included in the Region's "Special Status/Sensitive Species Program" are listed in Table 34. The "Special Status/Sensitive Species Program" which includes the Regional Forester's Sensitive Species List is a proactive approach for meeting the Agency's obligations under the Endangered Species Act and the National Forest Management Act (NFMA), and National Policy direction as stated in the 2670 section of the Forest Service Manual and the U.S. Department of Agriculture Regulation 9500-4. The primary objectives of the Sensitive Species program are to ensure species viability throughout their geographic ranges and to preclude trends toward endangerment that would result in a need for federal listing. Species identified by the FWS as "candidates" for listing under the ESA, and meeting the Forest Service criteria for protection, are included on the Regional Forester's Sensitive Species Lists. Documented/Suspected: Documented means that an organism that has been verified to occur in or reside on an administrative unit. Suspected means that an organism that is thought to occur, or that may have suitable habitat, on National Forest System land or a particular administrative unit, but presence or occupation has not been verified.

Table 34. Occurrence of Forest Service Sensitive Species on MBS

Common Name	Scientific Name	Occurrence on National Forest System Lands
Birds		
American Peregrine Falcon	*Falco peregrinus anatum*	Documented
Common Loon	*Gavia immer*	Documented
Bald Eagle	*Haliaeetus leucocephalus*	Documented
Harlequin Duck	*Histrionicus histrionicus*	Documented
Amphibians		
Larch Mountain Salamander	*Plethodon larselli*	Documented
Van Dyke's Salamander	*Plethodon vandykei*	Suspected
Mammals		

Common Name	Scientific Name	Occurrence on National Forest System Lands
Townsend's Big-eared Bat	*Corynorhinus townsendii*	Documented
North American Wolverine	*Gulo gulo*	Documented
Mountain Goat	*Oreamnos americanus*	Documented
Terrestrial Invertebrates		
Broadwhorl Tightcoil	*Pristiloma johnsoni*	Documented
Shiny Tightcoil	*Pristiloma wascoense*	Documented
Johnson's Hairstreak	*Callophyrs johnsoni*	Documented
Valley Silverspot	*Speyeria zerene bremnerii*	Suspected

Peregrine Falcon

This species usually uses cliffs for nesting and forages prey (shorebirds, waterfowl, and songbirds) from riparian areas. The usually nest on ledges or small caves on high vertical cliffs overlooking plains or bodies of water (Welty 1975) and are aerial predators who feed mostly on birds. Much of the prey consists of species the size of pigeons and doves; however avian prey ranges in size from hummingbirds to Aleutian Canada geese (Pagel 2004-2006). There is a high density of both potential nesting habitat and riparian foraging areas on the Forest. However, snow and other climatological factors may limit the suitability of these sites for nesting.

Two nest sites have been located on the Forest and another adjacent to it. Peregrines lay 2-4 eggs in March-May, eggs hatch after an incubation period of 31-33 days. Fledging occurs when the young are between 37 and 45 days of age (56 days at the upper end). Juveniles continue to be fed and protected by the adults until they disperse, which can range from 3 weeks to 3 months (ibid.).

Peregrine falcons can be disturbed by human activity during the nesting season (ibid.). Disturbance can cause: nest sites and new territories to be abandoned; active nesting attempts to fail due to egg breakage; or divert adult attention from opportunities to forage and feed nestlings (ibid.).

Peregrine falcons were delisted in 1999 and the USFWS has committed to monitor populations nationwide five times at 3-year intervals and report results. Invasive plants do not directly affect peregrine falcons. Peregrine falcons in the Pacific Northwest are most affected by bioaccumulation of contaminants, and direct disturbance to their nesting at known or suspected nest sites; both which have caused numerous nesting failures during the previous 20 years of observation (ibid.).

Common Loon

Common loons typically breed on forest lakes with deep inlets or bays and numerous islands (McIntyre and Barr 1997). During migration, they aggregate on rivers, reservoirs, and lakes. They tend to winter in shallow, sheltered marine waters. In all situations, loons require water bodies with ample prey populations.

Size of lakes ranges between 19 and 7,800 acres (4-3150 ha), and maximum water depth ranges from 11 to 320 ft. In western Washington, loons nest on lakes and reservoirs between 200 ft. and 2800 ft.in elevation.

There is no known nesting activity by loons on the Forest.

Bald Eagle

Bald eagle habitat consists of nesting and wintering habitat that is often separated by hundreds to thousands of miles. Bald eagles prefer large trees for nesting (Stalmaster et al. 1985). Bald eagle nests are usually built in trees that dominate the surrounding area and have large horizontal branches. Trees selected for nesting are usually near water, for easy access to food. During the winter, bald eagles often roost in large groups (Stalmaster et al. 1985). Roosting areas are used at night although some eagles may remain there throughout the day. The eagles may congregate in specific trees, or staging areas, before flying to the roost area (Stalmaster et al. 1985). Winter roosts may be located in coniferous forests, which offer the most protection from the weather, or in deciduous forests (Stalmaster et al. 1985). Roost trees are usually larger than other trees in the stand.

There are currently two nest sites on the Forest at Baker Lake, although only one is usually active. Wintering bald eagles concentrate on and move between several Washington rivers to feed on salmon carcasses, including the Skagit, Nooksack, Stillaguamish, Skykomish, Nisqually, Okanogan, upper Columbia, and Spokane. The Skagit River usually attracts the highest numbers, with up to several-hundred eagles gathering in the river basin to feed primarily on chum salmon, but also coho and steelhead (Taylor 1989; Dunwiddie and Kuntz 2001).

Some nesting eagles are sensitive to disturbance (USDI 1986). The critical period in Washington when human activities could disturb occupied nest sites extends from January 1 until August 15 (USDI 2003, p. 9). Nest initiation, including courtship and nest building, occurs in January through March. Incubation occurs from March until late May, and young are in nests from early April through mid-August. Young usually remain in the nest area throughout August.

Wintering eagles on the Forest can be sensitive to disturbance from October 31 to March 31 (USDI 2003, p. 9). The Forest utilizes a winter limited operating periods near foraging and roosting bald eagles from October 31 to March 15.

Harlequin Duck

Harlequin ducks nest along fast-flowing rivers and mountain streams in the Cascade Range of Oregon and Washington. It is hunted in Washington and Oregon. Harlequin ducks forage heavily on caddis flies, and will also eat some mayflies and stoneflies (Marshall et al. 2003). They apparently eat fish only rarely.

This species uses numerous drainages on the Forest (including but not limited to: Sauk, Suiattle, North Fork Stillaguamish, and White Chuck). Nests are built along stream edges in mature and large conifer forest or mixed forest within riparian zones of Class 1 through 3 streams. Maintenance of water quality and down wood is important for caddis flies, a major food source. Down wood also provides potential nesting and hiding sites within riparian areas.

Larch Mountain Salamander

Larch Mountain salamanders occur in a wide array of habitat types including: (1) old-growth forests; (2) younger naturally regenerated forests in gravelly/cobble soils with residual late successional features (snags and large down logs); (3) scree and talus (forested and un-forested); and (4) lava tube entrances where debris (e.g., pieces of lava, wood, fine organic and inorganic particles) has accumulated. In a large portion of the species range, late-seral forest conditions appear to be crucial to the species existence. In other areas, combinations of rocky substrates, soils, and vegetation provide suitable cool, moist microhabitat conditions necessary for Larch Mountain salamanders to exist.

The Larch Mountain salamander is found along a 36-mile stretch of the Columbia River Gorge and in isolated populations to the north in the Washington Cascade Range and to the south in the Oregon

Cascade Range. In Washington, they occur to about 120 mi) north of the Columbia River Gorge in Clark, Cowlitz, Skamania, Lewis, King, Pierce, Klickitat, and Kittitas Counties. The northern extent of its range is suspected to be Highway 2. Despite years of survey on the MBS since 1997, in apparently suitable habitat, the species has been found only in the southeast portion of King County.

Most of its life is spent in the subterranean environment and it is surface-active about 20 to 90 days a year, depending on location and conditions. Surface activity is triggered whenever moisture and temperature regimes are appropriate, primarily in the spring and fall. In the Columbia River Gorge this tends to be mid-February through late-May and in the fall from late September through late-November. In the Cascade Range, the activity period is approximately April through late June and late September to late November. Ideal conditions are when temperatures are between 4 degrees and 14 degrees C and soil is saturated to a depth of about 30 cm. Breeding takes place in the autumn and spring months. There is no free-living larval stage (Hallock and McAllister 2005a). Mites and springtails have been found to be common prey.

Van Dyke's Salamander

Habitat affinities are poorly understood for this species and habitat associations for the Cascade Range populations have not been assessed. In some respects, this species appears a generalist, because it may be found in a variety of habitats at a large range of elevations (sea level to over 5,000 feet). This species has been found along streams (Wilson et al. 1995), in upland forests (Slater 1933), talus (Herrington 1988), along lake shores (Crisafulli 2004) at cave entrances (Aubry et al. 1987), and at seeps (Leonard et al. 1993). Within the different habitat types, this species tends to seek out cool and moist or wet cover.

The salamander is endemic to the State of Washington (Leonard et al. 1993). The distribution is disjunct, even among populations in the Cascade Range. It is known from three population centers: the Cascade, Willapa, and Olympic Mountain Ranges. In the Cascade Range, it is known from only 28 sites west of the crest to the Puget Trough. Along the axis of the range, it is known from central Skamania County to the south, to the north end of Mount Rainier, Pierce County, to the north. Populations may be small and disjunct from one another and much potential habitat appears to be unoccupied (Wilson et al. 1995). The northern extent of its range is suspected to be Highway 2. Despite years of survey on the MBS since 1997, in apparently suitable habitat, the species has not been found.

Most surface activity takes place in the spring after snowmelt and before summer drought and in the fall after the onset of fall rains and before temperatures approach freezing. More specifically, most surface activity occurs when soil moisture is high (moist or wet) and soil temperatures are between 4 degrees to 14 degrees C (Hallock and McAllister 2005b). Because this species may occupy wet habitats, it is sometimes surface active even in the summer. Nests found on the Olympic Peninsula (elevations below 700 meters) were laid in early May and development was completed by early October (Hallock and McAllister 2005b). Females brood and guard the eggs during the summer.

Townsend's Big-eared Bat

The Townsend's big-eared bat is a non-migratory species dependent on caves, or cave-like structures including mines year-round. These caves occur in a wide variety of habitat types and elevations from sea level to 10,000 feet (NatureServe 2011, Siemers 2002). Townsend's will also use rock crevices, rock faces/cliffs, buildings, tunnels, bridges, and trees as day or night roost sites (Dobkin et al. 1995, Ellison et al. 2003, Mazurek 2004).

One young is born from April to July (Maser et al. 1981). Big-eared bats hibernate in winter and are not known to migrate long distances. These bats are very intolerant of human disturbance at either winter hibernacula or summer roosts (Csuti et al. 1997).

In addition to cave or cave like habitat, primary components include suitable foraging habitat that provides insect prey and water sources for both drinking and foraging. Considered a moth specialist, preferred prey items include small moths 0.23-0.47 inches from the families Noctuidae, Geometridae, Notodontidae, and Sphingidae, with opportunistic foraging on beetles and flies (Pierson et al. 1999). Although Townsend's are considered moth specialists, they can be considered habitat generalists in terms of foraging as they appear to forage successfully in a wide range of habitats, and particularly in edge habitat.

They forage in riparian areas, intermittent streams (Seidman and Zabel 2001), wetlands, and lakes, and along forest/shrub edges, ridges, or canopy, where insects concentrate (Burford and Lacki 1998, Clark et al. 1993). They also glean insects directly from foliage or other substrates. Although they appear to avoid large, open areas (Pierson et al. 1999), and areas of dense, regenerating forests, estimates of canopy coverage necessary to create suitable foraging conditions are unknown. Clark et al. (1993) found foraging in open, uncluttered areas enhanced the ability of Ozark big-eared bats to navigate and distinguish insects but it increased their risk to predation. Woodland edge habitat offered a less cluttered environment, some cover, and a high prey density.

Wolverine

In California, Oregon, and Washington, the wolverine inhabits various forest types in remote wildernesses with adequate food (Banci 1994). Wolverines inhabit dense coniferous forests and use open sub-alpine forests up to and above the timberline. Typically, they use high elevation alpine wilderness areas in the summer and montane forest habitats in the winter. Prey items include small and medium-sized mammals, birds and their eggs, insects, fish, roots, berries, and carrion. Wolverines are known to regularly avoid human-generated disturbance, and are sensitive to any disturbance; they will move natal den-sites several miles if disturbed.

In the 19th century, wolverines were found throughout the Cascade Mountains, Rocky Mountains, Central Great Plains, Great Lakes, Upper Midwest, and the northeast United States. Currently, the U.S. population is estimated at 250 to 300 individuals, mostly concentrated in the northern Rocky Mountain Range, with some occurring in the Pacific Cascade Region. Populations in Canada and Alaska do not appear to be in decline. In recent years there have been documented sightings of wolverines on the MBS.

Mountain Goat

Goats are native to the North Cascade Mountains and are often found in areas with cliffs that provide security and escape cover from predators.

Using the 2008 WDFW statewide estimates, and updating this data with more recent survey information, there are an estimated 1,098 mountain goats on the MBS. This total includes animals that are known to spend most of their time on the Wenatchee National Forest, and animals from Mount Rainier and North Cascades National Parks that spend at least some of the winter on the MBS.

Broadwhorl Tightcoil

The range of this species is from southwestern British Columbia through the north Cascade Range in western Washington, and south to northwestern Oregon. It is reported from many widely separate locations, although relatively few sites have been recorded in any region. The species appears to be more or less coastal, although it occasionally occurs at inland sites (e.g. the western slope of the Cascades) (Frest 2005). Sites in British Columbia include Vancouver Island near the towns of Nanaimo and Duncan. Washington sites include the Cascades, the San Juan Islands, and the Olympic Peninsula, including Clallam, Jefferson, King, Kitsap, Pacific, Pierce, San Juan, Snohomish, and Whatcom Counties (Branson 1977 and 1980, Dall 1895, Pilsbry 1946, Deixis 2009, Burke 2009, pers. comm.) Since this species has been rarely found/documented, habitat associations given are general. Sites are generally very moist, with coastal influence. Typical site descriptions include abundant ground cover (e.g., salal, oxalis, sword fern, and grasses), conifer or hardwood overstory, and moderate to deep litter. Despite years of survey on the MBS since 1997, in apparently suitable habitat, the species has not been found.

Shiny Tightcoil

This species is reported from many widely separate (but often imprecise) historic locations. It is known from the Washington and Oregon Cascade Range (Branson 1977, Frest and Johannes 1999, Branson 1980). It is also reported from the Blue Mountains in Oregon (Wallowa Valley above Wallowa Lake in Wallowa County) and from several counties in Idaho (Washington, Adams, Boise, and Shoshone) (Pilsbry 1946, Frest and Johannes 1999). A historic record from Marion County, near Salem, suggests possible Coast Range occurrence (Frest and Johannes 1999). Various sites in the Washington Cascades (Mount Rainier National Park) have revealed this or a very similar species; specimens from this area are in need of further survey and study, and should be compared to the original *P. wascoense* material (Burke 2009). A site in Olympic National Park originally reported appears to be in error (Burke 2011).

Sites are generally in Ponderosa Pine/Douglas fir plant associations at moderate-high elevations. Other *Pristiloma* species in the ecoregion are known to prefer moist microsites such as basalt talus accumulations, usually with riparian influence. There is maybe potentially suitable habitat for this species in the immediate vicinity of the project area. Despite years of survey on the MBS since 1997, in apparently suitable habitat, the species has not been found.

Johnson’s Hairstreak

These butterflies occur within coniferous forests which contain the mistletoes of the genus Arceuthobium, commonly referred to as dwarf mistletoe. These plants are highly specialized and are known to occur on a number of different conifers (Schmitt and Spiegel 2008). Dwarf mistletoe-infected conifers are common in northeastern Oregon, and current dwarf mistletoe levels are not believed to be substantially less than historic levels in this area. It is likely that surveys have not been numerous enough to reveal all locations of breeding populations and the range of the species is probably more widespread.

It has been speculated that old-growth forests are particularly suitable to this species of butterfly, although Arceuthobeium mistletoes also occur in younger forests as well, where there is an absence of recent large-scale disturbance (Schmitt and Spiegel 2008). Larsen et al. (1995) states that old-growth and late-successional second-growth forests provide the best habitat for this butterfly, although younger forests where dwarf mistletoe is present also supports hairstreak populations. All sightings in both Washington and Oregon have been in coniferous forests. Perhaps one reason for infrequent sightings of this butterfly could be the species spending a majority of its time in the top of the forest canopy (Scott 1986; Pyle 2002).

In Washington, Johnson’s hairstreak has been documented from the Olympic National Forest, Mt. Baker-Snoqualmie National Forest, and the Gifford Pinchot National Forest. There are 42 Washington records for Johnson's hairstreak (Hinchliff 1996). Forty-one of the 42 WA records are from less than or equal to 2,100 feet elevation—they range from 0-2,100 feet—and the outlier is from 2,700 feet from southern Skamania County (Potter 2005). Most Washington records are old, they range from 1891 to 1995; however, most are pre-1970 when there was considerably more low-elevation old-growth forests. (Hinchliff 1994; Potter 2005).

Evidence of a declining range with populations is very localized and scarce. Many records of this insect tend to be old, those from Washington range from 1891–1995, with many being pre-1970 when there were more old-growth forests at lower elevations (Hinchliff 1994; Potter 2005; cited by Xerces Society 2009).

Valley Silverspot

This subspecies is historically known from southwestern British Columbia south to west-central Oregon. In British Columbia, it occurs on Vancouver Island and Salt Spring Island, although recent searches of these islands found only a few surviving populations (GEORT 2003). It has also been recorded in British Columbia's Lower Mainland but these are likely strays or historical populations that are now extirpated (GEORT 2003). In Washington this species occurs on the San Juan Islands, along the Washington Coast Range, and in the Puget Trough (Pyle 2002). *Viola adunca var. adunca* is known as a larval food plant of this subspecies in Oregon; in British Columbia (Vancouver Island) the larvae are reported to feed on *V. palustris* (reviewed in Warren 2005). Males may be found visiting mud or patrolling sunny areas, with the exception of hilltops. This subspecies inhabits windy peaks with nearby forest openings. It is also found in native prairies and grasslands, often tending towards more mesic sites (Pyle 2002, Hammond 2006).

Management Indicator Species

Management Indicator Species (MIS) are selected species whose welfare is believed to be an indicator of the welfare of other species using the same habitat or a species whose condition can be used to assess the impacts of management actions on a particular area (Thomas et al. 1979). Selected habitat types and the representative terrestrial management indicator species from the MBS Forest Plan (USDA 1990) are displayed in Table 35.

Table 35. Terrestrial Management Indicator Species on MBS

Species	Preferred Habitats	MIS Habitat Category	Habitat Present in Analysis Area	Species Present or Suspected in Analysis Area
Bald Eagle	Roost, nest habitat and forage areas near lakes, reservoirs, rivers with readily available food source (fish and carrion)	Threatened and Endangered Species Habitat	Y	Y
American Peregrine Falcon	Cliff habitat for nesting	Threatened and Endangered Species Habitat	Y	Y
Gray Wolf	Security habitat > 300 m from road and high use trails	Threatened and Endangered Species Habitat	Y	Y
Grizzly Bear	Core habitat > 300 m from road and high use trails	Threatened and Endangered Species Habitat	Y	Y
Mountain goat	Rocky slopes >40 degrees adjacent to forage and cover	Big-game Sensitive Species Winter Range	Y	Y
Northern Spotted Owl	Mature, old-growth forests (nesting, roosting, foraging). Second-growth used for dispersal	Threatened and Endangered Old-Growth Forest Habitat	Y	Y
American Marten	Mature, old-growth forest >40% fir and canopy closure >50%	Old-Growth and Mature Forest	Y	Y

Species	Preferred Habitats	MIS Habitat Category	Habitat Present in Analysis Area	Species Present or Suspected in Analysis Area
Pileated Woodpecker	Mature, old-growth forest	Old-Growth and Mature Forest	Y	Y
Other Primary Cavity Excavators	Snags and downed logs in forested habitats	Snags and Downed Logs	Y	Y

Additional information and monitoring efforts on the population and habitat trends for MIS on the Forest can be found in the MBS Management Indicator Species Assessment (USDA 2011). The following paragraphs describe MIS species, except for Threatened, Endangered, and Sensitive species that were described previously (Bald eagle, peregrine falcon, gray wolf, grizzly bear, mountain goat and Northern spotted owl).

Pileated Woodpecker

Pileated woodpeckers are primary excavator species that inhabit mature coniferous forest habitats on the MBS, and are evaluated in regards to snag abundance and size class. The pileated woodpecker is the largest woodpecker species in the western United States and nests in cavities of large trees or snags. Pileated woodpeckers use mature and older, closed canopy stands for nesting and roosting, but may use younger (40-70 years), closed-canopy stands for foraging if large snags are available; large snags and decadent trees are critical habitat components for pileated woodpeckers; down logs do not appear to be an important foraging substrate for pileated woodpeckers on the west side of Oregon and Washington (Hartwig et al. 2004, Mellen et al. 1992, Raley and Aubry 2006).

It is a denizen of mature forests, relying on dead and decaying trees for foraging and nesting. Pileated woodpeckers can act as a keystone habitat modifier by excavating large numbers of cavities that are depended upon by several other species, and by influencing ecosystem processes such as decay and nutrient cycling (Aubry and Raley 2002). Pileated woodpeckers will return to areas after timber harvesting (Ehrlich 1988), however, past management in the Pacific Northwest has led to relatively few snags and down logs, especially of large diameters, remaining in many watersheds. Previous timber harvest, as opposed to wildfire events, has had the greatest effect on the availability of large diameter standing dead trees on the MBS.

American Marten

This is a Management Indicator Species that is associated with older forests, in the Pacific silver fir forest association. Marten occur in forests containing snags and down logs, which provide suitable denning sites. Marten are most closely associated with heavily forested east and north-facing slopes that contain numerous windfalls (Maser 1998). They tend to avoid areas that lack overhead protection and the young are born in nests within hollow trees, stumps, or logs. Although marten may be found in all forested zones, higher densities of marten are primarily found in the Pacific silver fir and mountain hemlock forest zones. Marten may occur in and around the proposed activities.

Other Primary Cavity Excavators

A large number of species rely on cavities in trees for shelter and nesting. The MBS has designated a group of species for this Management Indicator category. This group of species represents snag-dependent cavity nesters, and includes animals dependent on dead or dying trees for nest sites. Primary cavity excavators comprise a broad group of species associated with standing dead trees or snags and down logs, and that excavate their own nests.

Downy woodpecker, hairy woodpecker, northern flicker, red-breasted nuthatch and red-breasted sapsucker are cavity nesters common on the MBS. Pileated woodpeckers also rely on snag habitat.

Survey and Manage Species

The Survey and Manage species list considered conforms to the 2001, 2002, & 2003 Annual Species Review changes and meets the provisions of the 2001 Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines. Survey and Species associated with the MBS as of the 2003 Annual Species Review are listed in Table 36.

The 2001 decision amended the Survey and Manage direction and reorganized Survey and Manage species into six species categories (Categories A-F) based on rarity and survey practicality (USDA Forest Service and USDI Bureau of Land Management 2001). Categories A and C require that site-specific, pre-disturbance surveys be conducted prior to signing NEPA decisions or decision documents for habitat-disturbing activities. Habitat-disturbing activities are defined as those disturbances likely to have a significant negative impact on the species' habitat, its life cycle, microclimate, or life support requirements.

Pre-disturbance surveys are not necessary or required prior to invasive plant treatments for Survey and Manage vertebrate and mollusk species. The invasive plant treatments proposed do not create habitat-disturbance or have a significant negative impact on species' habitat, life cycle, microclimate, or life support requirements. The following analysis provides the rationale for why the invasive plant treatments are not habitat disturbing.

Table 36. Survey and Manage Species on the MBS

Common Name	Scientific Name	Survey and Manage Category	Management Direction
Larch Mountain Salamander	*Plethodon larselli*	A (Rare, Pre-disturbance surveys practical)	Manage All Known Sites, Project Level Surveys Prior to Habitat Disturbing Activities, Strategic Surveys
Van Dyke's Salamander	*Plethodon vandykei*	A (Rare, Pre-disturbance surveys practical)	Manage All Known Sites, Project Level Surveys Prior to Habitat Disturbing Activities, Strategic Surveys
Puget Oregonian	*Cryptomastix devia*	A (Rare, Pre-disturbance surveys practical)	Manage All Known Sites, Project Level Surveys Prior to Habitat Disturbing Activities, Strategic Surveys

Larch Mountain and Van Dyke's salamander were previously discussed in the above section on Forest Service Sensitive species.

Puget Oregonian

The Puget Oregonian snail is found from southern Vancouver Island, B.C. south through the Puget Trough and western Cascade Range in Washington to the Oregon side of the Columbia River Gorge. This species may be found in low- to mid-elevation mature or old-growth forest habitat (less than1500 feet elevation), typically this snail's habitat consists of mature to late-successional moist forest and riparian zones, springs, and seeps where canopy cover is generally high. Rocks and talus, which are cool and moist beneath, may also be used. The Puget Oregonian hides under logs, moss, leaf litter, and/or talus; often under, near, or on large (greater than 20 inches d.b.h.) big-leaf maple (*Acer macrophyllum*) and vine maple (*Acer circinatum*). However, despite surveying in apparently suitable habitat over the past 14 years, the species has not been detected in on the MBS.

January 2001 Survey and Manage ROD and Standards and Guidelines - Protection Buffer Species

These Protection Buffer species includes the white-headed woodpecker, black-backed woodpecker, pygmy nuthatch, and flammulated owl. These species are not known to occur on the MBS.

Bat Roost Sites – The Northwest Forest Plan Standards and Guidelines calls for protection of caves, and abandoned mines, wooden bridges and buildings that may be used as roost sites by bats, specifically fringed myotis, silver-haired bat, long-eared myotis, long-legged myotis, pallid bat, and Townsend's big-eared bat. These roost site features maybe located at or near the project sites.

Birds of Conservation Concern and Migratory Birds/Landbird Conservation

The MBS lies within Bird Conservation Region Five (Northern Pacific Forests). Within this region, the MBS provides significant habitat within Region Five, based on range maps in NatureServe Explorer (NatureServe 2005, Ridgely et al. 2003) and forest survey information for five species listed by the United States Department of Interior Fish and Wildlife Service (FWS) as "Birds of Conservation Concern." These species include black swift (*Cypseloides niger*), rufous hummingbird (*Selasphorus rufus*), olive-sided flycatcher (*Contopus cooperi*) bald eagle (*Haliaeetus leucocephalus*), and peregrine falcon (*Falco peregrinus*).

In 1999, Partners in Flight released a conservation strategy for landbirds in coniferous forests of western Oregon and Washington (Altman 1999). The strategy identifies a select group of focal species and their associated habitat attributes that can be used to identify desired forest landscapes. All of the focal species identified (Altman 1999, Table 3, p. 20) are found on the Mt. Baker-Snoqualmie National Forest. The strategy is intended to help facilitate land management planning for healthy populations of native landbirds. The document focuses on landscape-scale forest management, with emphasis on habitat structure. The conservation options recommended in the strategy are not relevant to invasive plant treatments because the treatments proposed do not involve modifying forest habitat structure or any other modifications to native habitat.

Some land bird (song bird) species on the MBS, including neo-tropical migratory birds, use mixed conifer/deciduous forests for nesting and foraging. Suitable nesting and foraging habitat is likely adjacent or near to proposed activities. The proposed activities are located in the area covered by the Oregon-Washington Partners in Flight Bird Conservation Plan for west side coniferous forests. The vegetation throughout the Forest provides habitat for focal species. Young and old forest habitat is represented on the Forest and considered adequate for conservation of priority bird species. Lists of landbirds common to the MBS are available in the Wildlife Biologist's Specialist Report.

Additional Wildlife Concerns

Big Game: Deer and Elk

These two species are known throughout the MBS. Deer and elk provide recreational, aesthetic, spiritual, and subsistence values to residents of northwestern Washington. There are two established herds of elk that reside on the Forest as year-round residents, as well as a few individuals that are migratory.

Deer occur throughout the forest, and both species use a combination of habitats comprised of cover and forage areas that are not too fragmented by road systems. Taber and Raedeke (1980) reported that winter mortality, legal harvest, and poaching were the primary causes of elk mortality. Poaching is the second leading cause of mortality to elk in Washington State (WDFW 2004). As one might expect, a high density of roads can have a negative impact on elk with increased disturbance from legal hunting and poaching (CEMG 1999).

Numbers of deer and elk have decreased in size over the past 15 years. Foraging habitat may be a limiting factor at present, and the availability of forage in the future is a concern.

The MBS has a Limited Operating Period restriction for projects in winter range from December 1 to April 1. The calving area Limited Operating Period is May 15 to July 1.

Amphibians and Amphibian Decline

Many species of amphibians in many parts of the world have experienced alarming population declines in the past 2 decades. International task forces have been formed and scientists have researched causes. A number of studies have documented declines, even in relatively undisturbed habitats (Drost and Fellers 1996, Lips 1998), while other studies have found some populations to be stable (Pechmann et al. 1991). However, detecting actual population declines in amphibian populations is difficult due to the extreme annual variation in populations caused by environmental factors, such as drought (Pechmann et al. 1991, Reed and Blaustein 1995).

Potential causes of amphibian declines investigated include ultraviolet radiation (Starnes et al. 2000, Adams et al. 2001), pesticides (Bridges and Semlitsch 2000), global warming (Blaustein et al. 2001, Crump 2005) habitat loss, non-native predators (e.g. Drost and Fellers 1996, Knapp and Matthews 2000), and disease (Muths et al. 2003, Berger et al. 1998, Berger et al. 1999), among others. Results of studies are variable and some populations are in decline while others are not. There is no “smoking gun” and all the causes are implicated to some degree (Halliday 2005).

Hayes et al. (2003, 2006) found that exposure to the herbicide atrazine caused hermaphroditism and testicular oocytes in African clawed frogs and wild leopard frogs and suggested that this could be concern in regard to amphibian declines. Population level effects to amphibians from atrazine exposure are unclear as wild leopard frogs were abundant at collection sites for the Hayes et al. study (2003).

Honeybees and Colony Collapse Disorder

The European honey bee (*Apis mellifera*) is not native to the American continents, but was introduced by European settlers in the 1600s. It is widely distributed and commercially produced in the U.S. with escaped feral colonies formerly present across most of the country (parasitic mites have destroyed most of the feral honey bees across the United States (CCD Steering Committee 2007)). The honey bee is used to pollinate agricultural crops and produce honey. The honey bee adds about $15 billion in value to agricultural crops each year (Morse and Calderone 2000).

In 2006-2007, commercial honey bees in North America and other parts of the world experienced alarming declines characterized by the disappearance of adult bees from the hives with no or few dead bees near the hive; healthy, capped brood; food reserves that have not been robbed; minimal evidence of wax moth or hive beetle damage; and a laying queen with immature bees and newly emerged attendants (CCD Steering Committee 2007, Winfree et al. 2007). This phenomenon has been termed “colony collapse disorder.” By 2007, almost 30 percent of beekeepers in the U.S. reported losses of up to 90 percent of their colonies (Cox-Foster et al. 2007; Winfree et al. 2007). CCD has not been reported in wild native bees (Winfree et al. 2007).

Suspected causes of CCD include the following factors, alone or in combination: (1) environmental and nutritional stress; (2) new and /or re-emerging pathogens; (3) pests that attack bees; and (4) pesticides

(CCD Steering Committee 2007). Several major setbacks to honey bee populations over the last 2 decades have combined to increase stress on the remaining hives, as they are moved and worked for their pollination services over longer seasons and larger geographic areas. Climate change, drought, and unseasonably cold weather combine to create increased stress on bee populations. Commercial bees are often fed high fructose corn syrup, which may contribute to some nutritional deficiencies. Nutritional deficiencies are thought to make the bees more susceptible to attack from pathogen and anecdotal evidence indicates that hives that are fed nutritional supplements over the winter are more resistant to CCD (Anonymous 2009).

Pathogens are primary suspect because CCD is transmissible to other hives through the reuse of equipment from CCD-affected colonies, and such transmission can be broken by irradiation of the equipment before use (Pettis et al. 2007). A recent paper using current gene technology has indicated that Israeli acute paralysis virus is strongly correlated with CCD and is a current leading candidate for its cause, alone or in combination with other factors (Cox-Foster et al. 2007, Kaplan 2008). Another recent paper implicates an infection from the parasite *Nosema ceranae*, but losses from CCD in hives treated for this parasite may differ between European and American hives (Higes et al. 2009, Goodman 2009).

Pests including the varroa mite, small hive beetle, wax moth, and others stress bees and may harbor infectious agents. In particular, the varroa mite has been responsible for catastrophic losses of 50 to 100 percent in many beekeeping operations and has eliminated most feral bee colonies. In addition, the varroa mite is known to carry pathogens transmitted to bees and is thought to suppress the immunity of honey bees (Shen et al. 2005).

Pesticide exposure may affect bees through direct toxicity or by adding additional stress. Beekeepers treat hives with miticides and fungicides and bees may be exposed to pesticides while foraging on agricultural crops. Currently, the classes of pesticides thought to be the most likely contributors to, and being researched for correlation with, CCD include insecticides, miticides, and fungicides (CCD Steering Committee 2007). Recent research has found higher-than-expected levels of miticides and traces of a wide variety of agricultural chemicals in bee hives, but no consistent pattern in levels or types of chemicals identified (Kaplan 2008).

3.5.3 Environmental Consequences to Wildlife

3.5.3.1 Introduction

The following section is a general overview of the potential impacts to federally listed wildlife from all herbicide treatment methods included in the proposed action. Impacts are described for federally listed threatened and candidate species, Regional Forester’s Sensitive Species, management indicator species, USFWS Birds of Conservation Concern, and Landbirds. For all methods of treatment, Management Requirements and Mitigation Measures (MR/MM) could be used to mitigate the majority of these impacts.

The MR/MM listed in Chapter 2.4 fulfill R6 2005 ROD Standards 19 and 20 to minimize or eliminate adverse effects to wildlife species of concern. These MR/MM are part of the proposed action and are mandatory in order to stay within the scope of this effects analysis.

Effects of invasive plant treatment methods to wildlife were evaluated and discussed in detail in the R6 2005 FEIS Appendix P, the corresponding Biological Assessment (USDA Forest Service 2005d), project files, and SERA risk assessments (2001, 2003, 2004, 2007, 2011). Risk assessments for glyphosate, imazapyr, triclopyr, and picloram were updated in 2011 (SERA 2011a-d). These documents indicate that disturbance from manual and mechanical treatment pose greater risks to terrestrial wildlife species of local interest than herbicide use. Exposure scenarios used to analyze potential effects from herbicides are discussed in Appendix P of the R6 2005 FEIS (pp. 15-17). The potential effects to birds from herbicides are listed in Table 4-9 of the R6 2005 FEIS. Some additional exposure scenarios over a threshold of concern were identified, however, given the R6 2005 ROD standards and MR/MM associated with this project, along with the type of infestations and their location in relationship to wildlife habitats, the updated risk assessments do not lead to new findings related to wildlife impacts for this project.

A summary of direct and indirect effects to terrestrial wildlife species of concern follows:

For spotted owls and marbled murrelets, loud and sudden noises above background or ambient levels (those above 92 dB) can cause disturbance that might flush a bird off the nest or abort a feeding attempt. Vehicles used to spray roadside vegetation with herbicides do not make noise above 92 dB, based on recent field measurements, so no “injury” or “harassment” from noise will occur. Other mechanical devises proposed for use on invasive plants include brushing machines, mowers, chainsaws, and string trimmers. These tools have the potential to create noise above background levels that may disturb owls or murrelets if used close to nests during the early nesting season. Bald eagles and peregrine falcons could be disturbed by these same tools, as well as human presence, but eagles and falcons are quite variable in their responses to activity and noise in the vicinity of their nests or roosts.

Small species that lack rapid mobility (e.g., mollusks and salamanders) are vulnerable to crushing or injury from people or equipment.

Invasive plant treatments as proposed would not alter native habitat structure or composition for terrestrial wildlife species, including MIS, or bird species included in Birds of Conservation Concern (USDI 2002) or the Partners in Flight strategy for landbirds (Altman 2000). In some cases, removal of invasive plants could cause a much localized decrease in the amount of vegetative cover provided. Due to the patchy nature of the invasive plant infestations, the amount of cover lost would be so small that it is not measurable in a meaningful manner. Unlike other management activities, such as timber harvest, invasive plant treatments do not reduce habitat available to native wildlife. Likewise, prey availability would not be reduced because invasive plants are located in relatively small patches, or along narrow road corridors, within and adjacent to the much larger natural habitats in which the prey reside.

Risk from herbicide exposure was determined using data and methods outlined in the SERA risk assessments. Tables 8 and 9 in the Biological Assessment for the R6 2005 FEIS (USDA Forest Service 2005d, pp. 138-140) list the toxicity indices used as the thresholds for potential adverse effects to mammals and birds (respectively) from each herbicide. A quantitative estimate of dose using a “worst case” scenario was compared to these toxicity indices. There is insufficient data on species-specific responses to herbicides for free-ranging wildlife, so wildlife species were placed into groups based on taxa type (e.g. bird, mammal), body size, and diet (e.g. insect eaters, fish eaters, herbivores). Quantitative estimates of dose for each animal grouping for each herbicide are contained in the project file worksheets.

Data is very limited or lacking on potential adverse effects of herbicides to mollusks and amphibians. There is some data to suggest that amphibians may be as sensitive to herbicides as fish (Berrill et al. 1994; Berrill et al. 1997; Perkins et al. 2000), so for this analysis, herbicides that pose potential risk to federally listed fish (as determined by the quantitative estimates from exposure scenarios) will also be considered to pose a risk to amphibians. Glyphosate, picloram, and sethoxydim (not proposed for use in this project) were identified as posing potential risks to fish in the aquatic species BA (USDA Forest Service 2005d). Sulfometuron methyl was specifically tested on amphibians and it may cause malformations, but only at very high application rates. Triclopyr used in a broadcast spray scenario may pose a risk to fish and amphibians, but a Standard in the Forest Plan restricts triclopyr to selective application methods only, minimizing the opportunity for exposure. In addition, MR/MM were specifically developed to eliminate exposure and provide additional protection to mollusks, amphibians and other aquatic species.

Relyea (2005) found no effect to three species of aquatic snails from the glyphosate formulation Roundup. Only glyphosate and picloram have been tested on a terrestrial mollusk; the brown garden snail (*Helix aspersa*). Neither glyphosate nor picloram appeared to pose a risk to the snail (see USDA Forest Service 2005d, Appendix B).

Under "worst case" scenarios, mammals and birds that eat insects or grass may be harmed by some herbicides and surfactants. Amphibians also appear to be at higher risk of adverse effects due to their permeable skin and aquatic or semi-aquatic life history. The 2011 glyphosate risk assessment indicates that use of POEA surfactants may be associated with greater impacts that use of glyphosate alone.

The "worst case" exposure scenarios do not account for factors such as timing and method of application, animal behavior and feeding strategies, seasonal presence or absence within a treatment area, and/or implementation of MR/MM. Therefore, risk is overestimated when compared to actual applications proposed in this EIS. POEA surfactants would not be used in this project.

Nonetheless, caution in the design and implementation of the project is warranted. In many cases, insufficient data is available to allow for a quantitative risk assessment. For instance, there is no quantitative scenario for a predatory bird that eats primarily other birds, such as the peregrine falcon, so the "fish-eating bird" scenario was used as a surrogate. This scenario likely overestimates the dose to the peregrine falcon because the hypothetical fish consumed are from a pond contaminated by a large spill of herbicide. These hypothetical fish likely have higher concentrations of herbicide in their bodies (and thus a higher dose to the predatory bird) than would a small bird that incidentally ingested herbicide before it was preyed upon. Also, data was insufficient to assess risk of chronic exposures for insect-eating birds and mammals for several herbicides.

The limited spatial extent of infestations, which are limited primarily to disturbed roadsides (see Chapter 2.5), and the limits placed on herbicide applications will reduce exposure of wildlife to herbicides. Standards 19 and 20 adopted in the R6 2005 ROD require that adverse effects to wildlife species of local interest from invasive plant treatments be minimized or eliminated through project design and implementation. In addition, Standard 16 restricts broadcast use of triclopyr, which eliminates plausible exposure scenarios. All action alternatives must be designed to comply with these standards.

To account for uncertainty, the Mitigation Measures and Management Requirements (MR/MM) place restrictions on how and where herbicides are applied. For example, MR/MM eliminate most broadcast herbicide treatments near perennial streams; minimize disturbance to certain habitats during certain times of the year; and limit the amount or proportion of certain habitats that may be treated in a 30-day period. The Forest Plan Standards and MR/MM ensure that no alternative adversely affects federally listed species; results in a trend toward listing of any sensitive species; nor adversely impacts the habitat of Management Indicator Species, landbirds, or Birds of Conservation Concern.

3.5.3.2 Direct and Indirect Effects of Alternative 1 – No-Action Alternative

Environmental analysis for existing projects (2005 MBS EA and the 2008 Skiyou Island EA) concluded that there would be no adverse effects to any federal listed, Forest Service Sensitive, or Management Indicator Species.

Under the No-Action Alternative, herbicide use would be restricted to small sites and few formulations. Some infestations would not be effectively treated and would likely continue to expand. See Chapter 3.2 for more information on the reasons that the No-Action Alternative is not fully effective. Habitat for a variety of wildlife could likely degrade to a point that it becomes unsuitable. Infestations that become so well-established that future treatment is cost-prohibitive may result in a permanent loss of wildlife habitat (Asher 2000).

3.5.3.3 Direct and Indirect Effects of Action Alternatives on Threatened and Endangered Species

The majority of the treatments proposed would occur in areas that are low quality or non-habitat of the wildlife species considered with approximately 44 percent of the treatment site acreages occurring on road shoulders, and 18 percent in plantations. There would be 25 percent of the sites along stream banks/lake shorelines, with the remaining acreage occurring in a mix of forest lands, wilderness, dispersed and developed recreation sites, administrative sites, and other areas.

Alternative 2 would permit the additional use of aminopyralid, including broadcasting to the water's edge on some larger infestations, but otherwise, it would permit the same amount and types of invasive plant treatments as Alternative 3. Aminopyralid is not associated with any herbicide exposure scenarios over a threshold of concern to wildlife, whereas, some of the other herbicides pose risks under some, albeit unlikely, scenarios.

However, the effects to wildlife are not substantially different between the alternatives because either adverse effects from herbicide exposure are unlikely or not plausible, required MR/MM avoid or minimize adverse effects from manual and mechanical techniques, the species are not limited to riparian habitats, or the wildlife species are not present within project area units or likely to be present in future areas treated under EDRR.

In regards to noise disturbance, required MR/MM will avoid or minimize adverse effects to most species. A small amount of noise disturbance due to mechanical mowing may impact nesting northern spotted owl and marbled murrelet.

Endangered Species consultation is underway with the USFWS for all of the federally listed species present on the MBS. Consultation for the MBS would use the same MR/MM for northern spotted owl and marbled murrelet found in the USFWS Biological Opinion for Effects to Northern Spotted Owls, Critical Habitat for Northern Spotted Owls, Marbled Murrelets, Critical Habitat for Marbled Murrelets, Bull Trout, and Critical Habitat for Bull Trout from Selected Programmatic Forest Management Activities (Ref # 13410-2009-F-0388) for the Olympic National Forest (USDI 2012).

The Section 7 ESA finding associated with the two federally listed bird species is "may affect, not likely to adversely affect," mainly due to the noise disturbance that may occur using mechanical treatment. There is a very low likelihood that herbicide exposure under this project would adversely affect birds. The finding for the two mammals (grizzly bear and gray wolf) is "may affect, not likely to adversely affect" because the likelihood of adverse impact is minimal.

Exposure scenarios used to analyze potential effects from herbicides are discussed in the 2005 R6 FEIS (Appendix P, pp. 15-17). Site-specific analysis was also conducted for this project, using the MBS application rates and updated risk assessments.

Northern Spotted Owl

Disturbance: The noise and activities associated with treatment actions have the potential to affect spotted owls in the project area. The response of spotted owls to project noise and activities is not well defined and is variable among individual owls. Spotted owl responses to noise disturbance range from no apparent reaction, to an alert response where the owls are attentive for the duration of the activity, to a flush response (Delaney et al. 1999, p.68).

Direct effects from invasive plant treatment include disturbance caused by noise, people, vehicles, and equipment. The potential for visual disturbance to cause harassment of spotted owls is low. Noise-generating activities above ambient could potentially cause enough disturbance to result in harassment of northern spotted owls during the breeding season. Noise or visual stimuli may interrupt or preclude essential nesting and feeding behaviors, cause flushing from the nest or missed feedings of young (USDI 2012).

Spotted Owl Responses to Chainsaws and Motorized Equipment: Delaney et al. (1999) reported that Mexican spotted owls exposed to chainsaw noise flushed when chainsaws were operated within a distance of 344 feet and the Equivalent Average Sound Level (LEQ; average sound level over time) for chainsaws was greater than or equal to 46 dBA LEQ (Delaney et al. 1999, p. 68). This sound level (46 dBA) was approximately 20–25 dBA above the natural background ambient levels (Delaney et al. 1999, p. 68). However, only 2.8 percent (1 of 36) of the chainsaw trials at distances greater than 197 feet resulted in a flush response, but over 70 percent of chainsaw trials at distances less than or equal to 197 feet resulted in a flush response (Delaney et al. 1999, p. 67). The sound levels associated with the chainsaw tests were in the range of 54 to 61 dBA at 197 feet (Delaney et al. 1999 p. 69).

Delaney and Grubb (2003, p. 22) reported that a northern spotted owl flushed in response to motorcycles passing within a distance of 220 feet. Spotted owls did not flush from nests or roosts when motorcycles were greater than 230 feet from their location (p. 22) and motorcycle noise was less than 75 dB SEL, unweighted (less than 62 dBA SEL, p. 34). The sounds associated with the motorcycle tests were readily distinguishable from ambient background levels, which varied from 30 to 38 dBA SEL (Delaney and Grubb 2003, p. 35).

Not all spotted owls exposed to chainsaw or motorcycle noise in these studies flushed, and spotted owls that were previously exposed to chainsaw noise were less likely to flush during subsequent exposures, suggesting some spotted owls have the ability to tolerate or habituate to such disturbances (Delaney et al. 1999, p. 69). Spotted owls also did not flush from nests during incubation or brooding of nestlings, suggesting that spotted owls are reluctant to leave the nest during the early stages of the breeding cycle (Delaney et al. 1999, p. 71; Delaney and Grubb 2003, p. 22). However, the researchers in the Mexican spotted owl study did not challenge incubating spotted owls with chainsaw noise at distances of less than 197 feet due to the high flush rates observed for non-nesting birds exposed to chainsaw noise at less than 197 feet (Delaney et al. 1999, p. 65). Although the samples sizes in these studies were small, there was no difference in the reproductive success or the number of young fledged for spotted owls exposed to experimental disturbance when compared with non-manipulated owls (Delaney et al. 1999 p. 66; Delaney and Grubb 2003, p. 21).

Temple and Guttiérez (2003, p. 698) conducted experimental chainsaw tests at a distance of 328 feet from non-nesting California spotted owls (*S. occidentalis*). Chainsaw operations at this distance did not induce a significant behavioral response in any of the owls (Temple and Guttiérez 2003, p. 700). After looking in the direction of the sound, most owls quickly resumed their previous behavior, such as sleeping or preening. Consistent with these observations, there was no difference detected in fecal corticosterone levels (a hormone that increases with physiological stress) in owls exposed to chainsaw noise and the control group (Temple and Guttiérez 2003, p. 700).

Disruption Distances for Spotted Owls from Chainsaws and Motorized Equipment: The experimental disturbance trials indicate that the combination of noise and human activity can cause nesting spotted owls to flush in certain situations, even at relatively low levels of noise above the background ambient conditions. Sound levels have been reported for many types of construction equipment (e.g., dump trucks, excavators) (FHWA 2006, section 9). However, sound attenuation rates are highly variable based on weather, vegetation, and terrain (Pater et al. 2009, p. 792). For example, sound levels recorded in the forest canopy are consistently higher than sounds measured at ground level due to a higher a rate of sound attenuation at ground level (Delaney and Grubb 2003, pp. 25-26).

Due to the variability of spotted owl responses to ground-based disturbances and the potential problems associated predicting sound attenuation, 195 feet is estimated to be a reasonable distance to assume a flush response is likely to occur from ground-based, motorized activities, even for activities that generate sound levels that are less than 92 dBA within a distance of 195 feet (e.g., chainsaws and most heavy equipment).

On the MBS, an unknown amount of spotted owl activity centers are located within 195 feet of treatment areas where brushing or mowing is currently prescribed. There is also an abundance of un-surveyed suitable habitat on the MBS where spotted owls could nest. Mowing and brushing uses machinery that can create louder noise, so treatment areas with these methods may disturb owls. Mowing within the Dan Creek (TAA-24) and Green Mountain (TAA-32) treatment analysis areas are near suitable habitat. Approximately 1.1 acres of suitable habitat at Dan Creek and 1.6 acres at Green Mountain could be disturbed during the breeding season.

However, under this consultation, the majority of individual project areas exposed to disruptive activities are small (less than 2 acres), and the duration of the exposure is expected to be brief (hours to 1 day) at any one location (e.g., use of mowers, brushing machinery). Individual and roadside sites present a relatively low risk to spotted owls due to the limited area exposed to noise and visual disturbance, and the short duration of the activities.

For other areas, the mandatory MR/MM for spotted owls requires that these methods, or others that generate sufficient noise (greater than 92 dB), to be conducted farther away than 195 feet, or outside the breeding season. This MR/MM will minimize effects to spotted owls because it minimizes or eliminates the source of disturbance near nests or suitable habitat.

Therefore, noise from mechanical and manual methods to control invasive plants, including equipment used to mow and spray roadside vegetation, “may affect, but is not likely to adversely affect” spotted owls.

Effects of Biological Control: No biological control agent that is currently present in the project area is adversely affecting northern spotted owls or their habitat. Future biological control agents used for invasive plant control are not likely to target or inadvertently affect habitat or prey of northern spotted owls, because they would not affect forest trees nor influence prey availability.

Effects of Herbicides: Exposure scenarios used to analyze potential effects from herbicides are discussed in R6 2005 FEIS, Appendix B, p. 461. None of the herbicides proposed for use applied at MBS application rates, pose a risk to northern spotted owls.

Spotted owls are not likely to be directly sprayed, or encounter vegetation that has been directly sprayed, because no aerial applications are proposed. Ground applications of herbicide would not reach the upper canopies of mature trees where the owls nest and forage.

Spotted owls within Douglas-fir/hemlock forests prey on flying squirrels, which are nocturnal and chiefly arboreal. Flying squirrels feed primarily on fungi and lichen. Arboreal owls or their prey are unlikely to be exposed to herbicides used within their activity centers in this forest type.

However, a worst-case exposure scenario for the spotted owl was conducted using consumption of prey that had been directly sprayed and assuming 100 percent absorption of the herbicide. The following interpretations of the exposure scenario results are made with the reservation that toxicity data was generated from laboratory animals which may not accurately represent potential effects to free-ranging wildlife.

At MBS application rates, the estimated doses from the exposure scenarios are all less than the reported NOAELs (no-observable adverse effect levels) for all herbicides. Therefore, adverse effects to spotted owls from the herbicides considered are not plausible.

Critical Habitat: Invasive plant treatments do not remove or modify any of the primary constituent elements that define critical habitat. The action alternatives would have “no effect” to critical habitat for the northern spotted owl.

Marbled Murrelet

Disturbance: Invasive plant treatments are associated with disturbance that may occur during the marbled murrelet nesting season. Direct effects from invasive plant treatment include disturbance caused by noise, people, equipment, and vehicles. However, the potential for visual disturbance to cause harassment of marbled murrelet is low.

Mowing and brushing uses machinery that can create louder noise, so treatment areas with these methods may disturb murrelets. There are an unknown amount of marbled murrelet sites within 100 yards of treatment areas that are currently prescribed for brushing or mowing. Noise-generating activities above 92 dB could potentially cause enough disturbance to result in harassment during the breeding season (USDI 2012). Vehicles used to spray roadside vegetation with herbicides do not make noise above 92 dB, based on the measurements taken, so no adverse effects to the marbled murrelet from noise disturbance will occur. Within 10 yards of a nest or un-surveyed suitable habitat, roadside spraying could create a brief noise of notice to marbled murrelets (e.g., slightly above 70 dB), but not loud enough to create disturbance resulting in “harassment” or “injury” (USDI 2012).

Mowing and brushing uses machinery that can create louder noise, so treatment areas with these methods may disturb owls. Mowing within the Dan Creek (TAA-24) and Green Mountain (TAA-32) treatment analysis areas are near suitable habitat. Approximately 1.1 acres of suitable habitat at Dan Creek and 1.6 acres at Green Mountain could be disturbed during the breeding season. The majority of individual project areas exposed to disruptive activities are small (less than 2 acres), and the duration of the exposure is expected to be brief (hours to 1 day) at any one location.

These individual and roadside sites present a relatively low risk to murrelets due to the limited area exposed to noise and visual disturbance, and the short duration of the activities. However, as described above, with a low average number of daily feedings, there is low potential for a missed feeding that disrupts normal growth and results in injury or developmental risk to a chick.

Murrelets would be exposed to noise and visual disturbance associated with treatment activities despite the low extent of treatments adjacent to habitat. The project includes MR/MM that all noise generating treatment activities that occur within or adjacent to murrelet nesting habitat would only occur 2 hours after official sunrise, and would cease 2 hours prior to official sunset during the murrelet nesting season (April 1 to September 23). This restriction reduces the potential to disrupt murrelets during their daily peak activity periods for feeding and incubation exchanges, but it does not ensure that all murrelets would be protected from disturbance under all circumstances.

For other areas, mandatory MR/MM for marbled murrelets requires that these methods, or others that generate sufficient noise, be conducted farther away than 100 yards, or outside the breeding season. This would minimize any potential disturbance. This MR/MM would minimize effects marbled murrelets because it minimizes or eliminates the source of disturbance near nests or suitable habitat.

Therefore, noise from mechanical and manual methods to control invasive plants, including equipment used to mow or spray roadside vegetation, "may affect, but is not likely to adversely affect" marbled murrelets.

Effects of Biological Control: No biological control agent that is currently present in the project area is adversely affecting marbled murrelet or their habitat. Future biological control agents used for invasive plant control are not likely to target or inadvertently affect habitat of marbled murrelet, because they would not affect forest trees. Since murrelets forage in the marine environment biological control agents would not influence prey availability.

Effects of Herbicide: None of the herbicides proposed for use, applied at proposed MBS application rates, pose a risk to marbled murrelets. Marbled murrelets are not likely to be directly sprayed, or encounter vegetation that has been directly sprayed. The proposed ground applications of herbicide would not reach the upper canopies of mature trees where murrelets nest.

Murrelets feed on marine fish, which would not be exposed to herbicides from control of invasive plants on lands administered by the Forest Service. It is not plausible for their primary prey to be exposed to herbicides considered in this analysis. However, some murrelets in some locations have been reported to feed upon some freshwater fish (Carter and Sealy 1986). Therefore, in order to investigate a worst-case scenario for exposure, a scenario involving the consumption of contaminated fish was analyzed. The potential for the herbicides included in the action alternatives to adversely affect marbled murrelets was determined using quantitative estimates of exposure from worst-case scenarios. The dose estimates for fish-eating birds were calculated using herbicide concentrations in fish that have been contaminated by an accidental spill of 200 gallons into a small pond.

Assumptions used include no dissipation of herbicide, bio-concentration is equilibrium with water, contaminant level in whole fish is used, and upper estimate assumes 15 percent of body weight eaten/day. For chronic exposures, a bird is assumed to consume fish from water contaminated by an accidental spill over a lifetime. All estimated doses used in effects analysis were the upper levels reported in the Forest Service/SERA risk assessments.

The following interpretations of the exposure scenario results are made with the reservation that toxicity data was generated from laboratory animals that may not accurately represent potential effects to free-ranging wildlife. The results of the exposure scenarios indicate that herbicide use for this project would not pose any plausible risk to birds from eating contaminated fish. All expected doses to fish-eating birds for all herbicides are well below any known NOAEL (see R6 2005 ROD, Appendix B). Even if they fed, for a lifetime, upon fresh-water fish that had been contaminated by an accidental spill of herbicide, they would not receive a dose that exceeds any known NOAEL. Therefore, marbled murrelets would not be adversely affected by herbicide use in any proposed alternative.

Critical Habitat: Invasive plant treatments do not remove or modify any of the primary constituent elements that define critical habitat. The action alternatives would have no effect to critical habitat for the marbled murrelet.

Grizzly Bear

Based on past records, grizzly bear may occur in remote areas of the Mt. Baker-Snoqualmie National Forest. The herbicide exposure scenario for large mammals consuming contaminated vegetation was used for the grizzly bear analysis. The foraging habits of grizzly make it possible for them to consume vegetation that has been sprayed with herbicide. Quantitative estimates of risk using "worst-case" scenarios (upper estimates) found three of the proposed herbicides (clopyralid, picloram, and triclopyr) have potential for chronic doses to exceed a threshold of concern, however there is low likelihood of such exposures for this project because of the little amount of habitat that would actually be affected compared to available habitat. Thus, chronic exposure is not plausible.

Triclopyr exceeds the toxicity index in an acute scenario (worst case, upper estimates). The grizzly bear would have to consume an entire day's diet of contaminated grass in order to receive this dose. Triclopyr would not be broadcast sprayed. Herbicide use would not occur proposed over large areas in which grizzly bear would forage. Grizzly bears are unlikely to forage exclusively on treated invasive plants, which are not their preferred forage. Also, the patchy nature of the applications makes it unlikely that the grizzly bear would forage exclusively on the scattered treated patches.

Invasive plant treatments in suitable habitat would be rare and located primarily along roads. Because it is highly unlikely that invasive plant treatments would coincide with grizzly bear presence, there would be no adverse effects to them regardless of alternative chosen.

Gray Wolf

Gray wolves do not likely occur with any regularity on the MBS. For the gray wolf the herbicide exposure scenario of a carnivore consuming a contaminated small mammal was used. No herbicide exceeded a level of concern in the scenario of carnivore consuming contaminated small mammals. Invasive plant treatments in suitable habitat would be rare and located primarily along roads. Invasive plant treatments in suitable habitat would be rare and located primarily along roads. Because it is highly unlikely that invasive plant treatments would coincide with gray wolf presence, there would be no adverse effects to them regardless of alternative chosen.

3.5.3.4 Direct and Indirect Effects of Action Alternatives on Regional Forester Sensitive Species

Under all alternatives, two primary effects on sensitive wildlife species are plausible: (1) disturbance and trampling from machinery or people treating invasive plants; and (2) risk from herbicide contact, particularly to species for which data is not sufficient to allow quantitative estimates of risk.

Sensitive species' habitat would be protected in all alternatives because invasive plant treatments do not remove suitable habitat for any species, and the majority of infestations occur along highly disturbed roadsides that do not provide suitable habitat. The extent of suitable habitat along highly disturbed roadsides is very low relative to the amount of suitable habitat that is not within a road corridor.

Results of the analysis indicate that mortality to Forest Service Sensitive Species is highly unlikely and effects are primarily limited to very short-term disturbance. No native habitat would be removed. The potential for trampling of mollusks is assumed in the analysis, but they are not known to occur in the target vegetation or treatment sites and it is not possible to quantify an effect to their population. In the absence of clear adverse effects to Forest Service Sensitive Species, no threat to viability of populations exists and population-level viability analysis is unnecessary. Treatment of invasive plants would prevent loss of habitat and improve habitat that may currently be degraded.

American Peregrine Falcon

Disturbance: Potential effects of invasive plant treatment methods on falcons are associated with disturbance that may occur during the nesting season. Direct effects from invasive plant treatment include disturbance caused by noise, people and vehicles. Effects from mechanical methods (e.g., tractors, bulldozers, chainsaws, or string trimmers) may occur at greater distances from the project site, because machinery creates louder noise.

The critical period in Washington when human activities could disturb occupied nests extends from January 1 to August 15 (USDI 2003, p.9). Peregrine falcons are sensitive to human disturbance during this time, particularly within sight distance of nest sites. Invasive plant treatments would avoid conducting projects that create noise or disturbance above ambient levels in proximity to an occupied nest during the nesting season, as required by MR/MM.

Invasive plant treatments would not result in the removal of falcon nests or suitable habitat, because invasive plants do not provide habitat. Projects could occur within suitable habitat.

Biological Control: No biological control agent that is currently present in the project area is adversely affecting peregrine falcon or their habitat. Future biological control agents used for invasive plant control are not likely to target or inadvertently affect habitat or prey of peregrine falcons, because they would not affect forest trees nor influence prey availability.

Herbicides: There is no quantitative scenario for a predatory bird that eats primarily other birds, such as the peregrine falcon, so the "fish-eating bird" scenario and the "mammal-eating bird" were used as surrogate scenarios. The fish eating bird scenario likely overestimates the dose to the peregrine falcon because the hypothetical fish consumed are from a pond contaminated by a large spill of herbicide. These hypothetical fish likely have higher concentrations of herbicide in their bodies (and thus a higher dose to the predatory bird) than would a small bird that incidentally ingested herbicide before it was preyed upon. Also, the small mammal in the "mammal-eating bird scenario" is directly sprayed. It would be practically impossible to directly spray a bird that a peregrine falcon would then immediately prey upon. Herbicide analysis indicates that no herbicide dose exceeded the toxicity indices for fish-eating or mammal-eating birds even at highest application rates in the "worst-case" scenarios.

In reality, a peregrine falcon feeding on a bird would not receive a high dose from its prey (as estimated by the scenarios) because the herbicides proposed in this EIS are rapidly excreted from animals and do not bioaccumulate. In the fish scenario, the fish are still within the contaminated water and therefore have some herbicide in their tissues. In the mammal prey scenario the prey has been directly sprayed and is covered with herbicide. So, if birds were exposed to herbicides and then subsequently preyed upon and consumed by peregrine falcons, the amount of herbicide that the peregrine would be exposed to is likely less than that modeled in the "worst case" scenarios using contaminated fish or small mammals.

The mandatory MR/MM would avoid disturbance, and no herbicide exceeded the toxicity indices for fish-eating birds even in a "worst case" scenario, so there would be "no impact" to peregrine falcons regardless of alternative chosen.

Common Loon

The loon is currently not known to nest on the MBS. They may winter as visitors but are not known as breeding residents. Invasive plant treatments are planned to be a combination of herbicide and manual techniques and would occur during spring and summer. No dose of herbicide exceeded toxicity indices even in a "worst case" scenario. Since the treatments would occur when loons are not likely to be present, and herbicide effects are not plausible, there would be "no impact" to common loons from proposed treatments, regardless of alternative chosen.

Bald Eagle

There are a total of two bald eagle sites within 0.5 mile of treatment analysis areas. All sites would involve the presence of operators or crews. No sites within 0.25 mile propose the use of mechanical equipment (motorized string trimmers). The proposed treatments within 0.5 miles of eagle sites are primarily along roads that have infestations of invasive plants.

Disturbance: Potential effects of invasive plant treatment methods on bald eagles are associated with disturbance that may occur during the nesting season. Direct effects from invasive plant treatment include disturbance caused by noise, people and vehicles. Human and vehicle presence can disturb bald eagles during the breeding season, causing the birds to leave nests, or stay away from the nest long enough to have detrimental effects to eggs or young (USDI 1986). Effects from mechanical methods (e.g. tractors, bulldozers, chainsaws, or string trimmers) may be more likely to occur at greater distances from the project site, because machinery creates louder noise.

The critical period in Washington when human activities could disturb occupied nests extends from January 1 to August 15 (USDI 2003, p.9). Bald eagles are sensitive to human disturbance during this time, particularly within sight distance of nest sites. Invasive plant treatments would avoid conducting projects that create noise or disturbance above ambient levels in proximity to an occupied nest during the nesting season, as required by MR/MM.

Invasive plant treatments would not result in the removal of bald eagle nest or roost trees, or suitable habitat, because invasive plants do not provide habitat. Projects could occur within suitable habitat.

Two bald eagle nests occur within 0.25 mile of proposed TAAs. Because disturbance is a plausible occurrence, all action alternatives may affect bald eagle. However, the MR/MM included in all alternatives would minimize the likelihood that disturbance to nesting eagles would actually occur.

Wintering bald eagles on the MBS can be sensitive to disturbance from October 31 to March 31 (USDI 2003, p. 9). Disturbance near winter roost sites is not likely to occur in any alternative because invasive plant treatments generally do not occur during the winter and MR/MM would minimize or eliminate the source of disturbance near winter roosts.

Biological Control: No biological control agent that is currently present in the project area is adversely affecting bald eagles or their habitat. Future biological control agents used for invasive plant control are not likely to target or inadvertently affect habitat or prey of bald eagles, because they would not affect forest trees nor influence prey availability.

Herbicides: Herbicides and surfactants applied according to MR/MM, pose no risk to bald eagles. Bald eagles are not likely to be directly sprayed, or encounter vegetation that has been directly sprayed, because no aerial application is proposed. No ground applications of herbicide would reach the upper canopies of mature trees where bald eagles nest.

The potential for the herbicides to adversely affect bald eagles was determined using quantitative estimates of exposure from worst-case scenarios. The dose estimates for fish-eating birds were calculated using herbicide concentrations in fish that have been contaminated by an accidental spill of 200 gallons into a small pond. Assumptions used include no dissipation of herbicide, bioconcentration is equilibrium with water, contaminant level in whole fish is used, and upper estimate assumes 15 percent of body weight eaten/day. For chronic exposures, we used a scenario where the bird consumes fish from water contaminated by an accidental spill over a lifetime. All estimated doses used in effects analysis were the upper levels reported in the Forest Service SERA Risk Assessments.

The following interpretations of the exposure scenario results are made with the reservation that toxicity data was generated from laboratory animals, which may not accurately represent potential effects to free-ranging wildlife.

The results of these exposure scenarios indicate that no herbicide poses plausible risk to birds from eating contaminated fish. Expected doses to fish-eating birds for all herbicides are well below any known No Observable Adverse Effect Level (NOAEL - see R6 2005 FEIS, Appendix B). The weight of evidence suggests that adverse effects to bald eagles from NPE or the herbicides included in the action alternatives are not plausible.

The MR/MM would avoid disturbance, and no herbicide exceeded the toxicity indices for fish-eating birds even in a “worst case” scenario, so there would be “no impact” to bald eagles, regardless of alternative chosen.

Harlequin Duck

Harlequin ducks nest along fast-flowing rivers and mountain streams in the Cascade Range. Invasive plant treatments along fast-flowing sections of river and mountain streams are likely to be rare for a variety of reasons. Infestations of invasive plants are less likely along swift sections and higher gradient streams than in slower river bottom habitat. It is more difficult for seeds and propagules of invasive plants to become established in swift water. If invasive plants become established along some swift water areas, they may not be treated because terrain and swift water limit access to the infestation. However, some invasive plant infestations could be treated in potential harlequin duck habitat with moderate flow. Invasive plants may degrade duck habitat if left untreated.

Disturbance to nesting ducks could occur along the shore from people treating invasive plants either manually, with string trimmers (weed whackers), or with herbicides. Manual and mechanical treatments are likely to cause more disturbance and of longer duration than treatments with herbicide. However, most herbicide treatment projects involve a component of manual or mechanical treatment, so there would be some disturbance regardless of the technique used. Duration of disturbance from any method is expected to be a maximum of 3 to 4 hours in a single day and only occurring once during the nesting season.

These ducks eat aquatic invertebrates and fish, so risk from herbicide exposure is evaluated using a “fish-eating bird” scenario. A quantitative estimate of dose was calculated for a bird eating contaminated fish for 1 day (acute) and for a lifetime (chronic). The fish are from a pond (1000 m2 by 1 m deep) that has been contaminated by a spill of 200 gallons of herbicide. No herbicide exceeded a dose of concern for any exposure (acute or chronic) at any application rate (typical or highest). Based on available data, adverse effects to fish-eating birds from the herbicides in this analysis are not likely.

While harlequin ducks only rarely eat fish, there is not sufficient data to quantitatively estimate dose from consuming contaminated insects. Because harlequin ducks are found along swift water, any herbicide that inadvertently entered the water would be rapidly diluted and moved downstream. This would greatly reduce exposure of this duck and its prey to herbicide. The fish-eating bird scenario seems an appropriate “worst case scenario” to use as a surrogate for analysis. Results from this scenario indicate that herbicides would not pose a risk of adverse effects to harlequin ducks.

Differences in potential effects between the alternatives would be minor and based on the degree and duration of disturbance. However, because some disturbance would still occur with herbicide treatment and herbicide treatments often include manual or mechanical treatments as well; potential differences in effects are not substantial enough to differentiate between alternatives.

The magnitude and duration of any disturbance or herbicide exposure is low level and short term. Therefore, treatments proposed "may impact individuals, but are not likely to lead to a trend toward federal listing" for harlequin ducks for all action alternatives.

Larch Mountain Salamander

According to database records, Larch Mountain salamander is documented on the Mt. Baker-Snoqualmie National Forest. A single detection occurs within a proposed treatment site (33-07r4). There is also additional suitable, but un-surveyed, habitat on the forest. Some un-surveyed habitat occurs in forest blocks adjacent to roadside treatments. The salamander MR/MM would minimize exposure of this species to the herbicides most likely to have adverse effects. Limiting broadcast application of herbicides within potential salamander habitat reduces the likelihood and amount of herbicide that could contaminate water, soil or rocks used by salamanders. In addition, there is little overlap between the habitat for these salamanders and locations of infestations to be treated. Because there is minimal overlap between actual treatment sites and salamander habitat, and project design criteria minimize exposure to herbicides, this project "may impact individuals, but is not likely to lead to a trend toward federal listing" of these salamanders for all action alternatives.

Van Dyke's Salamander

Mechanical treatments near streams and springs can create ground disturbance that could introduce silt into salamander habitat, potentially clogging the gills of the salamanders and resulting in mortality. Little is known about the effects of herbicides other than the potential for some herbicides to cause mortality or result in malformations of amphibian larvae. Effects of herbicides to amphibians are discussed in the R6 2005 FEIS (Appendix P, pp. 28-31).

The aquatic and salamander MR/MM that limit broadcast application of herbicides and apply to all alternatives would minimize exposure of salamanders to the herbicides most likely to have adverse effects. Limiting most broadcast application of herbicides within potential salamander habitat reduces the likelihood and amount of herbicide that could contaminate water, soil or rocks used by salamanders. In addition, there is little overlap between the habitat for these salamanders and locations of infestations to be treated, as suggested by the aquatic influence zone acres described above. Most invasive plants occur in more open, drier, and previously disturbed sites. Because there is minimal overlap between actual treatment sites and salamander habitat, and MR/MM minimize exposure to herbicides, this project "may impact individuals, but is not likely to lead to a trend toward federal listing" of these salamanders for all action alternatives.

Wolverine

Based on past records, wolverines occur in remote areas of the MBS. For the wolverine the herbicide exposure scenario of a carnivore consuming a contaminated small mammal was used. No herbicide exceeded a level of concern in the scenario of carnivore consuming contaminated small mammals. Invasive plant treatments in suitable habitat would be rare and located primarily along roads. Because it is highly unlikely that invasive plant treatments would coincide with wolverine presence, there would be no adverse effects to them regardless of alternative chosen. Low intensity invasive plant treatments are unlikely to disturb wolverines. Therefore, treatments would have "no impact" to California wolverine for all action alternatives.

Mountain Goat

Even though the foraging habits of mountain goats make it very unlikely for them to consume vegetation that has been sprayed with herbicide, the herbicide exposure scenario of large mammals consuming contaminated vegetation was used. Quantitative estimates of risk using "worst-case" scenarios found that chronic exposure to clopyralid and picloram at MBS rates would exceed the toxicity index. Acute exposure to triclopyr at MBS rates could exceed the toxicity index. However, mountain goat would have to consume an entire day's diet of contaminated grass in order to receive this dose. Herbicide use is not proposed over large areas in which mountain goat would forage. Spot spraying and roadside broadcast spraying of invasive plants are not likely to mountain goats to harmful levels of herbicide because they are unlikely to forage exclusively on treated invasive plants, which are not their preferred forage. Also, the patchy nature of the applications makes it unlikely that the mountain goat would forage exclusively on the scattered treated patches.

Low intensity invasive plant treatments are unlikely to disturb mountain goats. Therefore, treatments would have "no impact" to mountain goat for all action alternatives.

Townsend's big-eared bat

This bat is known to have roosts on bridges within or near treatment analysis areas. Traffic along the roads and the bridges used for roosting was well-established when the bats colonized the bridges. Roadside treatments typically consist of a boom or nozzle spray attached to a pick-up truck, or a person with a backpack sprayer conducting spot sprays of plants. Both treatment methods only take a couple minutes to conduct, do not generate noise much beyond the background noise of the road and bridge use, and do not occur in close proximity to the bats themselves. Therefore, the likelihood of disturbing roosting bats during treatment of roadside invasive plants is remote. Invasive plants near bridges known to be utilized by Townsend's big-eared bats are not likely to adversely impact Townsend's big-eared bats.

The bats forage over large areas catching insects (primarily moths) in flight or by gleaning from vegetation. The small amount of acreage proposed for treatment, scattered in small patches, make it unlikely that the bats would forage within treated areas and on insects that have been inadvertently sprayed by herbicides. If contaminated insects were ingested, triclopyr and glyphosate could result a dose that exceeds the toxicity index. In order to receive this dose, the bat would have to consume nothing but contaminated insects for an entire nights feeding. Given the bats foraging habits, it is unlikely that bats would be exposed to this amount of herbicide. In addition, because the bats roost in crevices well above ground level during the day, it is not plausible that they could be directly exposed to spray of herbicides.

Data is lacking on risk from chronic exposure to contaminated insects. The likelihood of a chronic exposure to contaminated insects is remote, given the small acreages treated and the relatively large areas in which bats forage.

The bats are not likely to forage exclusively within treated areas over a 90-day period (the chronic exposure) so there does not appear to be a plausible risk from chronic exposure. Therefore, treatments would have "no impact" to Townsend's big-eared bats for all action alternatives.

Broadwhorl and Shiny Tightcoil

Habitat for these mollusks and any unknown populations would occur off the roads in adjacent suitable habitat. The majority of the proposed treatment analysis areas are along disturbed roadsides that do not provide suitable habitat for these mollusks. Roadside conditions are more dry and harsh than is suitable for mollusks.

No invasive plant treatments would remove habitat for mollusks nor would treatments cause large-scale microclimate changes within their suitable habitat. Habitat components for mollusks such as down logs would remain in place on treatment sites.

In all action alternatives, MR/MM require that treatments avoid known sites or high potential habitat when soil moisture is high and these mollusks are most likely to be at or near the surface. This would minimize their exposure to herbicides and reduce the risk of mortality by trampling.

These mollusks are not known within any treatment analysis areas, so there would be "no impact" to these mollusk species from any alternative.

Johnson's Hairstreak

These butterflies occur within coniferous forests which contain dwarf mistletoe. It has been speculated that old-growth forests containing mistletoe are particularly suitable for this species although younger forests with mistletoe are also suitable. Manual treatments would have no effect. The Johnson's hairstreak is unlikely to be exposed to herbicides because no trees would be treated and no aerial application, which could create drift over large trees, is proposed. Invasive plant treatments would have "no impact" on this species or its habitat for all action alternatives.

Valley Silverspot

Invasive plant treatments in suitable habitat or near unknown populations would be rare and located primarily along roads. Because it is highly unlikely that invasive plant treatments would coincide with valley silverspot presence, it is likely there would be any negative effects to them regardless of alternative chosen. Invasive plant treatments "may affect individuals, but is not likely to create a trend towards federal listing" for this species for all action alternatives.

Summary of Impact Determinations for Sensitive Species

Table 37 summarizes the reasons for impact determinations for Sensitive Species.

Table 37. Impact Determinations for Sensitive Species

Common Name	Impact Determination	Reason
American Peregrine Falcon	No Impact	MR/MM minimize potential for disturbance; adverse effects from disturbance or herbicides highly unlikely
Common Loon	No impact	Not likely present in treatment analysis areas; adverse effects from disturbance or herbicides highly unlikely
Bald Eagle	No Impact	MR/MM minimize potential for disturbance; adverse effects from disturbance or herbicides highly unlikely
Harlequin Duck	May Impact, not likely to lead to federal listing (MINL)	May be present in only a few treatment analysis areas, potential disturbance is short term and low magnitude, herbicide effect highly unlikely
Larch Mountain Salamander	MINL	Low likelihood of disturbance, adverse effects from herbicide unlikely, MR/MM minimize potential for effects
Van Dyke's Salamander	MINL	Low likelihood of disturbance, adverse effects from herbicide unlikely, MR/MM minimize potential for effects
Townsend's Big-eared Bat	MINL	Not likely present in treatment analysis areas; herbicide effects highly unlikely, disturbance unlikely
North American Wolverine	No Impact	Not likely present in treatment analysis areas; herbicide effects highly unlikely, disturbance unlikely

Common Name	Impact Determination	Reason
Mountain Goat	No Impact	Not likely present in treatment analysis areas; herbicide effects highly unlikely, disturbance unlikely
Broadwhorl Tightcoil	MINL	Low likelihood of disturbance, adverse effects from herbicide unlikely, MR/MM minimize potential for effects
Shiny Tightcoil	MINL	Low likelihood of disturbance, adverse effects from herbicide unlikely, MR/MM minimize potential for effects
Johnson's Hairstreak	No Impact	Not likely present in treatment analysis areas; herbicide effects highly unlikely, disturbance unlikely
Valley Silverspot	MINL	Low likelihood of disturbance, adverse effects from herbicide unlikely, MR/MM minimize potential for effects

3.5.3.5 Direct and Indirect Effects of Action Alternatives on Management Indicator Species

The invasive plant treatments proposed in all action minimize or eliminate effects to non-target native vegetation. These treatments would not remove native trees or alter native habitat structure. Proposed treatments would improve cover of native plants within treated areas. Habitat for pine marten, mountain goat, pileated woodpecker, and primary cavity excavators is not substantially affected by invasive plants, nor would it be affected by invasive plant treatments. Results of the analysis indicate that mortality to Forest Service MIS is highly unlikely and effects are primarily limited to very short-term disturbance. No native habitat would be removed. In the absence of clear adverse effects to all MIS, no threat to viability of populations exists and population-level viability analysis is unnecessary. Treatment of invasive plants would prevent loss of habitat and improve habitat that may currently be degraded.

Pileated Woodpecker

To analyze the effects of herbicides to the pileated woodpecker the scenario of birds consuming insects was used. There project area units that are in forested habitat or wildfire areas where herbicides could be used for invasive plant treatment. Species that forage and nest in trees are not likely to be exposed to herbicides because no trees would be treated and no aerial application, which could create drift over large trees, is proposed. However, the pileated woodpecker may feed on the ground or in low shrubs or on logs for a substantial portion of their diet. They may encounter contaminated insects. No herbicides except triclopyr (which cannot be broadcast sprayed) are a concern at typical application rates. MR/MM restricts application of triclopyr to the lowest effective rate. In addition, triclopyr would primarily be used for control of scotch broom and Himalayan blackberry, species that do not provide nesting or foraging habitat for the pileated woodpecker.

Given the varied diet and movement of these birds, it is very unlikely that they'd forage exclusively within one patch of treated invasive plants and actual doses exceeding levels of concern are unlikely. This species is not susceptible to the low magnitude, extent, and duration of disturbance caused by treating patches of invasive plants. Invasive plant treatments would not cause adverse effects to these species as a result of human or mechanical disturbance. No likely adverse effects from disturbance or herbicide exposure would occur in any alternative. Invasive plant treatments would not contribute to a negative trend in viability (negatively impact ability to meet the target population levels or habitat goals) the pileated woodpecker on the MBS.

Marten

Invasive plants are not typically found in the mature forest habitat types preferred by the marten. No herbicide exceeded a level of concern in the scenario of carnivores consuming contaminated small mammals. Invasive plant infestations are unlikely to occur in marten habitat except along disturbed roadsides, so disturbance to martens from manual or mechanical treatments are not likely to occur. Since there are no likely adverse effects from disturbance or herbicide exposure, there is no appreciable difference in effects between alternatives. Invasive plant treatments would not contribute to a negative trend in viability (negatively impact the ability to meet target population levels or habitat goals) of the American marten on the MBS.

Primary Cavity Excavators

To analyze the effects of herbicides to the primary cavity excavator group the scenario of birds consuming insects was used.

Herbicides may be used forested habitat or wildfire areas. However, primary cavity excavators are not likely to be exposed to herbicides because trees are would not be treated. Aerial spraying that could create drift over large trees is not proposed. Glyphosate and triclopyr (which cannot be broadcast sprayed) are a concern at MBS application rates under unlikely “worst case” estimates. Invasive plants do not provide nesting or foraging habitat of any of the species within the primary cavity excavator group.

Given the varied diet and movement of these birds, it is very unlikely that they would forage exclusively within one patch of treated invasive plants and actual doses exceeding levels of concern for any herbicide or surfactant are unlikely. None of these species are susceptible to the low magnitude, extent, and duration of disturbance caused by treating patches of invasive plants. Invasive plant treatments would not cause adverse effects to these species as a result of human or mechanical disturbance. Since there are no likely adverse effects from disturbance or herbicide exposure, there is no appreciable difference in effects between alternatives. Invasive plant treatments would not contribute to a negative trend in viability (negatively impact ability to meet the target population levels or habitat goals) of any primary cavity excavator on the National Forest.

3.5.3.6 Direct and Indirect Effects of Action Alternatives on Survey and Manage Species

The Larch Mountain and Van Dyke’s salamanders are addressed above as Sensitive species.

The single Survey and Manage mollusk (Puget Oregonian) is associated with a variety of moist forest and they retreat into down wood, leaf litter, and moist areas during the dry summer months (May or June through September). Mollusk habitat and any unknown populations would occur off the roads in adjacent suitable habitat. The majority of the proposed treatment analysis areas are along disturbed roadsides that do not provide suitable habitat for this mollusk. Roadsides conditions are more dry and harsh than is suitable for mollusks.

Invasive plant treatments would not remove habitat for mollusks nor cause large-scale microclimate changes within their suitable habitat. Habitat components for mollusks such as down logs would remain in place on treatment sites.

In all action alternatives, MR/MM require that treatments avoid known sites or high potential habitat when soil moisture is high and these mollusks are most likely to be at or near the surface. This would minimize their exposure to herbicides and reduce the risk of mortality by trampling.

This mollusk is not known within any treatment analysis areas, and likely does not occur on the MBS.

3.5.3.7 Direct and Indirect Effects of Action Alternatives on Other Species of Concern

Elk and Deer

The effects of herbicides to deer and elk were evaluated using the scenario of large mammals consuming contaminated vegetation. The grazing and browsing habits of elk and deer make it possible for them to consume vegetation that has been sprayed with herbicide. Quantitative estimates of risk using "worst-case" estimates (upper end) found that chronic exposure to clopyralid and picloram at MBS rates could exceed the toxicity index. Acute exposure to triclopyr at MBS rates could exceed the toxicity index. However, deer or elk would have to consume an entire day's diet of contaminated grass in order to receive this dose. No broadcast spraying is proposed over large areas in which deer or elk would forage. Spot spraying and roadside broadcast spraying of invasive plants are not likely to expose deer or elk to harmful levels of herbicide because they are unlikely to forage exclusively on treated invasive plants, which are not their preferred forage. Also, the patchy nature of the applications makes it unlikely that the deer or elk would forage exclusively on the scattered treated patches. Treatments would occur primarily during the summer months, a period when deer and elk are not typically found in the winter range or key elk area management areas, so they would be very unlikely to be exposed to these treatments.

Invasive plant treatments can create some disturbance, but the level of disturbance would be short term, low intensity, and limited extent. The majority of treatment analysis areas are along roads (>70%) where existing ambient disturbance occurs regularly. The level of disturbance would not create negative effects for these very mobile and wide-ranging species. Invasive plant treatments will have no negative effect on deer or elk. Since there are no likely adverse effects from disturbance or herbicide exposure, there is no appreciable difference in effects between alternatives. Invasive plant treatments would not contribute to a negative trend in viability or negatively impact ability to meet target population levels on the National Forest, or the ability to meet the State's population management objectives.

Treatment of invasive plants in winter range and key elk management areas, as well as all other areas including meadows and along roadsides in meadow habitat would beneficially affect deer and elk by preserving native forage species, maintaining or improving nutritional value, and maintaining the long-term suitability of the habitat. Invasive plants can reduce the ability of an area to support deer and elk (Rice et al. 1997). Maintaining and improving native herbaceous plants and shrubs would increase the nutritional value in these areas and contribute to increased animal health and ability of critical areas such as winter range and key elk habitat to support deer and elk.

Birds of Conservation Concern

The short term (1 day or less), low magnitude, and limited extent (usually 1 acre or less scattered over larger areas) of disturbance that would occur with invasive plant treatments would not cause negative effects to populations of birds in this category. In addition, raptors in this category are further protected from disturbance by MR/MM.

Effects to bald eagle and peregrine falcon have been discussed previously in the Forest Service Sensitive Species sections. Similar to the discussion for MIS, risks of herbicide exposure to the remainder of the Birds of Conservation Concern were evaluated by placing them into groups based on diet.

<u>Insectivorous birds</u> include the black swift and olive-sided flycatchers are not likely to consume enough contaminated insects to exceed a level of concern. Invasive plant treatments would have no negative effects to these species from either disturbance or herbicide exposure.

<u>Rufous Hummingbird:</u> The rufous hummingbird inhabits open areas and meadows, catching insects and sipping nectar. A small amount of exposure to herbicides could amount to a dose of concern because of

the very small body size of the rufous hummingbird. These hummingbirds could forage in open areas where invasive plants have been treated and possibly glean contaminated insects. It is unlikely that they would forage exclusively within a patch of invasive plants. These hummingbirds are not known to heavily utilize invasive plants for a nectar source and they prefer tubular flowers where the nectar is deep inside the corolla. Native forage plants would not be treated so the nectar is unlikely to be contaminated with herbicide. Rufous hummingbirds breed from Alaska south to Oregon. The patchy nature of the invasive plant infestations and the multi-state breeding range for this bird indicate that while adverse effects to some individual birds cannot be ruled out, there is not likely to be any population-level effect to the species from proposed invasive plant treatments on the MBS.

Invasive plant treatments would have no negative effect on Birds of Conservation Concern. Since there are no likely adverse effects from disturbance or herbicide exposure, there is no appreciable difference in effects between alternatives. Control of invasive plants would protect and improve important habitat for many of the birds included in this category.

Landbirds: Invasive plant treatments proposed on the MBS would not remove habitat of the focal species for coniferous forests. No trees would be removed and forest structure would not be altered by proposed treatments. Only species that forage or nest near the ground are likely to be exposed to disturbance from treatments or herbicides. Of the coniferous forest focal species identified in Altman (1999), the following species are most likely to forage or nest near the ground: varied thrush, winter wren, black-throated gray warbler, Hutton's vireo, olive-sided flycatcher, western bluebird, orange-crowned warbler, rufous hummingbird (Source: Altman 1999, Marshall et al. 2003). Because these species are not reported to nest in invasive plant species targeted for treatment, manual and mechanical treatments are not likely to disturb nests of these species.

As discussed above for Primary Cavity Excavators, analysis in the 2005 R6 FEIS (Appendix P) indicated herbicide exposures resulting in a dose of concern do not appear plausible for the proposed treatments, as detailed above for Primary Cavity Excavators, although risk to some individual birds cannot be ruled out.

In conclusion, invasive plant treatments would not alter habitat for focal species in the Partner's In Flight land bird conservation strategy. Manual and mechanical treatments are not likely to disturb nests of focal species. Some individuals of focal species could be exposed to herbicides by foraging on contaminated insects, but the likelihood of any dose of concern is remote.

3.5.3.8 Direct and Indirect Effects of Action Alternatives on Amphibian Decline

Information on the effect of pesticides on amphibian populations is limited, and the studies that are available often focus on the most toxic compounds like insecticides (e.g. Taylor et al. 1999, Bridges and Semlitsch 2000, Boone and Semlitsch 2001, Relyea and Mills 2001). Some herbicides are known to have adverse effects on amphibians (Hayes 2002, Wojtaszek et al. 2005).

To date, atrazine is the only herbicide active ingredient that has been implicated in overall amphibian declines (Hayes 2002). This herbicide is not proposed for use in this project.

Relyea (2005) implicate the glyphosate formulation Roundup in amphibian decline, but the formulation studied contains a toxic surfactant (POEA) that would not be used for this project. Numerous previous studies have attributed the toxicity of this formulation to the surfactant and not the glyphosate active ingredient (Mann and Bidwell 1999; Perkins et al. 2000).

The pesticides investigated (e.g., carbaryl, PCB's, atrazine) all have much higher propensity to accumulate in the fatty tissues than the herbicides proposed in this document. For example, Atrazine has an octanol/water partition coefficient (Kow) of 481 while the proposed herbicides have a KOW ranging from 2.1 to much less than 1. There is a substantial data gap regarding effects of the herbicides included in this analysis and the potential for effects to amphibian populations, but current data on these herbicides do not suggest a risk to amphibian populations because they do not accumulate in animal tissues and are less persistent, less mobile, and less widely used than pesticides that have been implicated in amphibian declines.

Management requirements, mitigation measures and herbicide use buffers have been proposed that respond to uncertainty about effects to amphibians from herbicide exposure. Broadcast spraying is prohibited and selective application methods are specified near streams, and the herbicide ingredients that can be used are limited within certain distances of amphibian habitat.

Direct and Indirect Effects of Action Alternatives on Colony Collapse Disorder

Herbicides have a low likelihood of being implicated in Colony Collapse Disorder (CCD). Other pesticides (e.g. miticides) may contribute to conditions that favor CCD. None of the herbicides included in the proposed action or alternatives exceeded toxicity values for honey bees at typical application rates. At highest application rates, only glyphosate caused any mortality, and this necessitated a direct spray at the highest rate. Herbicides are not typically used directly on the agricultural crops that honey bees pollinate because they would have a high likelihood of adversely affecting the agricultural crop (unlike on grass crops where selective herbicides are used on the crop directly). However, herbicides are used near these crops to control invasive plants.

Herbicides used in the proposed action or alternatives have a very low probability to cause any affect to honey bees or contribute to CCD because: (1) treatments on the forest are often in remote locations far from commercial bee hives; (2) treatments in the vicinity of bee hives would only entail treatment of patches of invasive plants and not a widespread application likely to expose honey bees; (3) these herbicides have a low toxicity to honey bees; (4) effects to bees from these herbicides only occurred for one herbicide at the highest application rate, which is not applied in a spray application (in practice, highest application rates of glyphosate are used in wicking, wiping, or injection applications which are unlikely to expose bees).

Currently, the pathogen Israeli acute paralysis virus and the parasite *Nosema ceranae* are the leading candidates for cause of CCD. In addition, recent studies (Cameron et al. 2011) show that the declining species have been reported to have lower genetic diversity and higher infection rates from the pathogen *Nosema bombi* than co-occurring species that are not declining. Causes for the higher susceptibility of declining species are unknown, but current research has not suggested that herbicides are a factor. In conclusion, neither the proposed action nor any alternatives are likely to have adverse effects on honey bees or contribute to the potential cause(s) of CCD.

3.5.3.9 Cumulative Effects of All Alternatives on Wildlife

All project alternatives would be beneficial to wildlife. Negative impacts to wildlife, including species of local interest, are far more likely with invasive plants than with the treatments proposed.

The basis for cumulative effects is discussed in Chapter 3.1.6. Current and proposed invasive plant treatments are generally very small (less than 1 acre and often less than 0.1 acre) with patches widely scattered across the landscape. The current infestations amount to approximately 0.3 percent of the Mt. Baker-Snoqualmie National Forest. The Forest is 1.7 million acres in western Washington, and treatments are limited to no more than 5,000 acres per year total. This cap, along with realistic budget constraints, further limit the size of treatments in any one location in sensitive wildlife habitats.

Infestations, and therefore treatments, are primarily along roadsides and other disturbed sites, which do not provide quality habitat for most wildlife. While some infestations do occur in important wildlife habitat like early seral stage vegetation or wetlands, MR/MM and herbicide use buffers minimize the potential for adverse exposure so much that there is virtually no potential for exposures to accumulate and cause harm to any habitat or species.

The analysis assumes that possible repeated treatments within the same season do not overlap in time, or result in a cumulative effect. If repeated treatments are necessary it is usually a result of missed plants during the first herbicide application or manual treatment effort. In the first instance a second herbicide application would not overlap spatially or in time, and in the second scenario, the duration of manual treatment and resulting effects are small. See direct and indirect effects for analysis of repeated human disturbance to Northern spotted owl and bald eagles.

The herbicides proposed for use would have no potential to bioaccumulate in any individual animal, and the potential for acute exposure is very small. The potential for an animal to be exposed to herbicide is limited to the area immediately adjacent to the application site (15-150 feet) and a short window of time (24 hours or less). Mobility, persistence, and toxicity are all managed through MR/MM.

Recently completed projects on the MBS include closing and restoring roads; road construction, reconstruction and maintenance; vegetation management (mainly thinning); and recreation development and maintenance. These projects occur within treatment analysis areas mapped within the project area (TAA 4, 15, 19, 23, 26, 27, 41, 43, 44, and 45) where invasive plant treatment sites occur within or near the recently completed projects.

Several projects are currently being implemented or are ongoing on the MBS. These include mining; a variety of recreation projects; road repair, closure, reconstruction/improvement, decommissioning and maintenance; stream restoration; and vegetation management (thinning and created openings). Projects are being implemented in TAA 2, 3, 4, 5, 6, 11 15, 16, 17, 20, 23, 27, 30, 32, 33, 36, 41, 43, 45, 47, 49 and 53.

Several projects are planned to be implemented in the foreseeable future. These include recreation and site maintenance; road closure, repair and reconstruction; vegetation management (mainly thinning and some created openings) and stream restoration. The projects overlap invasive plant treatments proposed in TAA 2, 4, 6, 11 14, 19, 23, 32, 33, 38, 32, 43, and 45. These projects may last for several years.

Negative cumulative effects to any wildlife species considered in this document are unlikely to remove or degrade wildlife habitat, pose substantial herbicide risks to wildlife, nor disturb wildlife. Thus, invasive plant treatments would not contribute to negative effects even when considering past, present, ongoing and foreseeable actions.

The herbicide use reported for invasive plant treatment near the MBS (see Chapter 3.1.6) is also unlikely to affect wildlife on the MBS. The scattered nature of invasive plant treatment would limit the potential effects on habitat or individual animals.

A discussion of cumulative effects to specific species or species groups follows.

Northern Spotted Owl and Marbled Murrelet

Northern spotted owls and marbled murrelets are also exposed to disturbance from vehicle traffic, recreation, timber harvest activities, development, and other potential sources of disturbance and habitat loss. Projects that are within the range of the northern spotted owl and marbled murrelet that are ongoing or reasonably foreseeable include commercial thinning, road maintenance, road repair, trail maintenance, and recreational use.

It is unlikely that there would be negative cumulative effects to northern spotted owls or marbled murrelets from the No-Action Alternative or action alternatives when added to past, present or reasonably foreseeable actions. Invasive plant treatments would create discountable or no effects from disturbance or herbicide exposure, and treatments do not remove or degrade habitat for northern spotted owl or marbled murrelet, thus, invasive plant treatments would not contribute additive effects to past, present or foreseeable actions.

Invasive plant treatments involve sites that are small patches, occur primarily along roads, create noise that is primarily within ambient noise levels, that would be treated in a matter of minutes, and likely repeated only once or twice, if at all, during the treatment season. Invasive plant treatments and activities associated with the previously mentioned vegetation management projects would be required to limit disturbance when in proximity to known owl nest sites. The probability of an effect from most activities in the No Action or either of the action alternatives is so low that it could not be added to other activities in a meaningful way. Even the small amount of noise disturbance from mechanical mowing at two infested sites, when considered across the landscape, is expected to have an indistinguishable contribution to cumulative effects to northern spotted owls or marbled murrelets.

Forest Service Sensitive Species

There would be no cumulative effects to the sensitive species Common loon, bald eagle, Townsend's big-eared bat, North American wolverine, mountain goat, and Johnson hairstreak. This is because none of the proposed invasive plant treatment alternatives would result in any effects to these species that could contribute to cumulative effects.

Invasive plant treatments involve relatively small, well-defined spatial areas. Most treatments are confined to patches infested with invasive plants while leaving interspersed native vegetation intact. Native wildlife habitat is not removed, modified, or degraded, nor are any hydrologic regimes affected. Treatments occur one to three times during a season, generally from late spring to mid-fall. Treatments are low intensity and of small magnitude and generally short duration (1 day or less). Given the spatial and temporal scale of invasive plant treatments, potential for cumulative effects is low.

Harlequin ducks could be disturbed by recreational activity as well as other activities occurring in riparian areas. Many riparian areas on the Forest receive intensive recreation use. Invasive plant treatments could add to the disturbance, but are such low magnitude, short duration, and low intensity that no significant cumulative effect is likely to occur. Cumulative exposure of harlequin ducks to herbicides could only occur for birds that move between the National Forest and other ownerships. Because the herbicides proposed for use in this project are rapidly excreted, do not bioaccumulate, and pose low risk to the birds, even if exposures occurred from multiple ownerships, they are unlikely to result in any cumulative toxic effect to these birds. The upper estimates for chronic exposure in the SERA Risk Assessments account for herbicide use on multiple ownerships. Based on available data, this project would not contribute to cumulative adverse effects to harlequin ducks.

Some individual salamanders could be trampled during invasive plant treatments. The magnitude and extent of trampling from invasive plant treatments is very low, however, and restricted to a few individuals present adjacent to invasive plant species. Trampling from invasive plant treatments are unlikely to add significantly to trampling or disturbance from other activities such as recreational activities. The alternatives would not contribute to adverse cumulative effects to salamanders because (1) minimal overlap exists between actual treatment sites and salamander habitat, and (2) MR/MM minimize potential salamander exposure to herbicides.

Some individual mollusks could be trampled during invasive plant treatments. The magnitude and extent of trampling from invasive plant treatments is very low, however, and restricted to a few individuals present adjacent to invasive plant species. Trampling from invasive plant treatments are unlikely to add significantly to trampling or disturbance from other activities such as recreational activities. Herbicide use and other treatments are unlikely to affect mollusks, this this project does not have the potential to contribute to cumulative effects to sensitive mollusks.

The valley silverspot can be found in areas containing a large amount of larval food plants (violets). Few invasive plants have been found in areas the valley silverspot may occur. None of the alternatives are likely to contribute to adverse cumulative effects to the valley silverspot because few past, current, ongoing or future projects overlap silverspot areas, and effects from invasive plant treatments are unlikely.

Management Indicator Species (MIS)

Results of the analysis indicate that mortality to Forest Service MIS is highly unlikely and effects are primarily limited to very short-term disturbance. No native habitat would be removed. In the absence of clear adverse effects to all MIS, no threat to viability of populations exists and population-level viability analysis is unnecessary. Treatment of invasive plants would prevent loss of habitat and improve habitat that may currently be degraded. Ongoing and reasonably foreseeable projects including vegetation management projects, road maintenance, road repair, trail maintenance, and ongoing recreational use would not contribute to cumulative effects to any of the MIS. Therefore, the effects from invasive plant treatments would not add to effects from past, present, or future projects.

Landbirds and Birds of Conservation Concern

Landbirds and Birds of Conservation Concern are negatively impacted primarily by habitat loss and fragmentation. Invasive plant treatments do not alter native habitat. Some birds can be harmed by insecticide applications, but the current and proposed herbicides have very low toxicities and are not expected to add to or accumulate with other herbicide exposures because they are not retained or stored in the body. None of the birds or their habitats are significantly affected by invasive plant treatments. Even effects to individuals have a very low probability of occurring. In many cases, there would be no effect at all to the birds or their native habitats. Therefore, the effects from invasive plant treatments would not add to effects from past, present, or future projects to create significant cumulative effects.

3.5.4 Consistency with Regulations, Policies and Plans

All alternatives would be consistent with the MBS Forest Plan. In addition, all alternatives comply with the Northwest Forest Plan (USDA, USDI 1994). The Survey and Manage mitigation measure from the Northwest Forest Plan has been litigated and modified since 1994. All alternative comply with the most recent Settlement Agreement (July 6, 2011). The alternatives also comply with specific provisions of the Endangered Species Act and Migratory Bird Treaty Act.

3.6 Soil

3.6.1 Introduction

The soils analysis focuses on herbicide application and the environment fate depending on site characteristics. Soil analysis topics include (1) the risks to soil organisms from treatments, (2) potential changes in vegetation cover that could result in soil erosion, (3) changes to plant and soil communities, and (4) risk for offsite herbicide transport.

A primary focus of the site-specific analysis for this project was developing Management Requirements and Mitigation Measures (MR/MM) to ensure compliance with the MBS Forest Plan (as amended by the R6 2005 ROD). Herbicide risk assessments by the Syracuse Environmental Research Associates, Inc. (SERA 2004a-d, 2007, 2011a-d) were used to identify pertinent characteristics of herbicide chemicals such as adsorption to soil, solubility in water and half-life of degradation. These herbicide characteristics were considered in relation to site-specific soil properties and treatment sites in proximity to streams and roads that are hydrologically connected to streams.

The Groundwater Loading Effect of Agricultural Management Systems (GLEAMS) model was used to approximate risk for transport through soil, leaching, and runoff using site physical characteristics (available [ONLINE] @ http://www.tifton.uga.edu/sewrl/Gleams/gleams_y2k_update.htm). GLEAMS simulations were parameterized for a woodland forested site in fair condition with moderate runoff potential. Soils were characterized as loam over sandy loam subsurface that represents the most common soil type on the MBS. The highest proposed herbicide application rates were used for the modeling.

3.6.2 Affected Environment

Invasive plants are most common within disturbed soil environment where light, water and soil nutrients are available along with a lack of plant competition (James et al. 2010). Invasive plants have traits that enable quick colonization and readily utilize the soil and water resources (Sutherland 2004). Roads have high rates of invasive plant establishment from the disturbed right of way and high seed spread from passing vehicles (Zouhar 2008, Birsall et al. 2011). Invasive plant spread is common on regularly used routes and along less traveled roads such as utility corridors. Much of the spread occurs from road maintenance activities including mowing and grading. The road disturbance footprint has gravelly road fill emplaced next to dugout ditches, and bared cut slopes. The right-of-ways generally have open light conditions to enable vehicle site distance. The seed rain from passing vehicle traffic along with transplanted road materials that carry invasive plant seeds creates a constant seed source for invasive plants (Zouhar 2008). Vehicle traffic congregation at recreation areas, parking lots and where forest management activities have a high potential for spreading invasive plant seeds.

Within the MBS current invasive plant sites, roadways and past forest management areas make up 76 percent of the invasive plant sites (Table 38). Invasive plants tend to spread on roads, skid trails, and log landings that occur within otherwise forested areas that are susceptible to shade tolerant invasive species. Recreation areas and administrative sites make up 8 percent of the invasive plant sites. Riparian areas account for 5 percent of total invasive plant sites, especially in areas with dynamic seasonal water flow that create open areas susceptible to invasive plant colonization. Pasturelands comprise 5 percent of total known invasive plant sites, including parcels recently acquired by the MBS. Pasturelands can be predisposed to invasive plants due to disturbance from past farming, grazing and intensive use around outbuildings. Wilderness infestations comprise less than 1 percent of the known sites, probably because high elevation environments resist invasive plant species growth and public access is more limited in wilderness.

Table 38. Acreage of Invasive plant Sites

Sites	Percent
Road	44.0
Forest management	28.0
Pasture/open space	5.0
Administrative	3.5
Power lines	0.3
Recreation	6.0
Waterways	5.3
Wilderness	0.7
Other	2.0

The Forest is located along the western Cascade mountain range and has a marine climate with cool conditions and abundant moisture from 90 to over 130 inches precipitation annually. Summers and relatively mild and dry, and winters are relatively cool and wet. The driest months are July and August, which may have a few inches or less of rain. In contrast, winter precipitation averages more than 20 inches a month. Snowfall is light in the lower elevations and heavy in the mountains (WRCC 2012).

Most the known weed occurrences on the MBS are below 5,000 feet elevation where the growing season is 100 to 160 days or more (NRCS 2003). Saturated conditions from snow-melt or rain limits the invasive plant growth, and cold conditions limit the extent of invasive plant spread. Invasive plant populations decline below 3,000 feet (Figure 3). Some invasive plants persist in high elevations, including Canada thistle, scotch broom and meadow hawkweed.

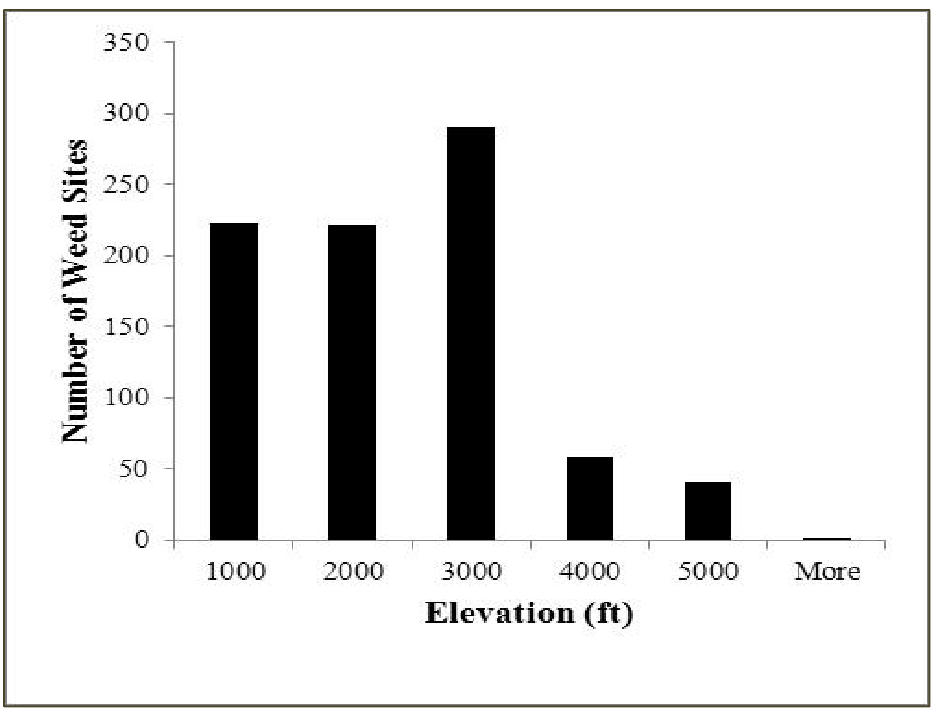

Figure 3. Invasive plant sites by elevation range

One of the dominant site conditions that determine invasive plant presence is the amount of sunlight. Shade intolerance is an important limiting growth variable as about 80 percent of the invasive plant species found on the MBS are shade intolerant Thus, edge habitats such as roadways, stream banks and lakesides favor invasive plants. However, shade tolerant species include periwinkle, elephant ear, holly, ivy, lily of the valley, herb Robert, three knotweeds, and jewelweed are particularly problematic as they can thrive under a forest canopy.

Disturbed areas create fertile conditions for invasive plants to thrive. Disturbing soil can increase mineral nutrient availability by churning and mixing soil. The churning breaks up organic matter for decomposers and stimulates nutrient production much like turning a compost pile. Pasturelands and moderately disturbed natural forest and grasslands are known to produce high nutrient levels (Smith et al. 2006). Disturbed areas in the lower elevations can be prone to invasive plant growth since nutrient production will be higher. Nutrient availability in soil depends on sufficient warmth and moisture (Davidson et al. 1998, Booth et al. 2004).

Conditions that resist invasive plants will be less fertile habitat. The natural forest setting may resist invasive plants due to the acidic soil conditions. Natural ecosystems are thought to resist invasion where native plants have unique relationships with soil organisms to survive stressful growing conditions. Spodic soils, common to the MBS from the high rate of leaching, have very low pH at 4.5 to 5.5. The acidic conditions favor fungal decomposers which can facilitate plant access to nutrients (Klironomos 2002, Kulmatiski et al. 2008).

3.6.2.1 Geological and Soil Context

The relatively recent action of glaciers has limited soil formation across the MBS. Soils need sufficient time to advance weathering of the parent rock into subsurface strata. The time since last glaciation was end of the Pleistocene, roughly 10,000 years ago. Large river valleys were sculpted from mountain terrain when ice sheets covered the MBS. Glaciers left thick beds of unconsolidated sediments filling the basins that then became the foundation for soils. Deposits on the mountain sides remain unstable and the sloughing action as slopes seek a lower angle of repose continues to inhibit soil formation. Soils have formed on somewhat stable surfaces on slopes, valley bottoms and ridge tops.

The mountainous landscape resulted from plate tectonics that created uplift and volcanism. Western Washington has been the leading edge of the North American plate since the early Paleozoic time (540 million years ago (Ma)), sliding over oceanic plates. The subducted edge of the oceanic plates was pushed far beneath the surface, experienced melt, and led to rising magma bodies that eventually expressed as the volcanoes of the Cascade Range. Subsequent accretion of islands and micro-continents to the continental edge have formed a belt of sedimentary and metamorphic rocks called a terrane (WSDNR 2010).

The metamorphic rocks that form the terrane dominates the northern part of the MBS, while extrusive andesite flows form the bedrock in the southern MBS. The Tertiary age andesite flows center around the Rainier strato-volcano. Adjacent to these flows, large areas of volcano-clastic rock such as ashfall tuffs and mudflow lahars form the bedrock. Snoqualmie batholith granites and granodiorites, roughly the same age as the volcanics, or upper Tertiary in age, become common north of the tertiary volcanics near Mount Stuart. The northern half or more of the MBS transitions to schist and gneiss that are part of accreted terrane that include large areas of marine sedimentary and ultra-mafic rocks (WSDNR 2010). The shift from volcanic to meta-sedimentary and sedimentary rocks is in the vicinity of the North Fork Stillaguamish River, along Highway 530.

The wide river valleys juxtapose with steep rising hill slopes representing the glacial carving and considerable uplift of the Cascade Range. For soil development and fertility, accumulated slope materials from surface and mass erosion advance chemical weathering of the parent material. Thus, the foot slope deposits have higher fertility than upper slopes. In the southern portion of the MBS, the foot slopes can accumulate large fan deposits from landslides and mudflows from the lahar. In the north, deposits may accumulate more as foot slope fans. The complex faulting from subduction and resulting volcanism creates raw bedrock scarps in this region. These slopes have too steep an angle of repose to hold eroding slope material and thus accumulate mainly foot slope material.

Loess and ash from the Cascade volcanic activity form fertile soils by providing a fine matrix that holds water for plant and soil biologic activity (McDaniel and Wilson 2007). An ash mantle persists on leeward mountain sides and where slopes remain somewhat stable. Ash and pumice deposits enhance soil depth beyond which natural soil formation would have occurred.

Table 39 shows dominant soil types (NRCS 2003) within the Snoqualmie NF portion of the MBS where invasive plant treatments are planned. This information was correlated with older survey data for the northern (Mt. Baker) portion of the Forest. The soil types are arranged from valley bottom to highest elevation to illustrate the change in growing condition and potential for growth.

The majority of the invasive plant sites occur on valley bottom and foot slope soils. Soil series on valley bottoms include the Snoqualmie, Skykomish, Grotto and Larrupin Series. The growing environment has a sustained mean annual temperature (MAT) of at least 44 degree F. Valley bottoms have well developed spodosol soils (Grotto Series) on stable old terraces and deeply developed ash rich, andisols on old mudflows (Larrupin Series), and less developed inceptisols and entisols where ash overlies till (Skykomish Series) and floodplains have recent river deposits (Snoqualmie Series).

Soils with fewer weed sites occur on spodosols along montane foot lopes and side slopes that have slightly colder MAT. These spodosols have very acidic conditions with pH in the range of 4.5 to 5.5. Optimum plant growth typically is around 6 to 7 pH. Higher elevations have spodosol soils with these similar characteristics, but colder temperatures and snow restrict invasive plant survival.

Table 39. Common soil types for the Snoqualmie NF (NRCS 2003)

Geomorphic Surface	Parent Material	Soil Series and Taxonomy	Precipitation (inches)	MAT* (inches)	pH	Growing Season (days)
Valley bottoms	alluvium on low river terraces	Snoqualmie Dystric Xerothents	50-90	48	6	130-180
Valley bottoms	glacial outwash terraces	Skykomish Typic Vitrixerands	50-80	45	5	130-160
Valley bottom river terraces and alluvium	terraces/mixed alluvium/glacial till	Grotto				
Valley bottom and sideslopes	Typic Haplorthods	60-100	45	5.9	130-160	1600-2800
Valley bottom and colluvial side slopes	ash over mudflow	Larrupin				
Mountain slopes	Typic Vitixerand	60-90	44	6.4	130-160	1700-2800
Cirques on lateral moraines	ash/cinders mixed with extrusive igneous colluvium	Pitcher				
Mountain slopes	Andic Dystroxerepts	55-80	44	6	130-160	1600-2800
Mountain back slopes	ash/ pumice mixed with andesite colluvium or till	Kaleetan				
Mountain slopes	Typic Haplohumods	90-130	44	4.6	130-160	1600-2800
Mountain slopes - cool slopes on lower elevations	ash/coll/till over till	Philippa orstein Humic Haplorthods	90-140	44	4.6	150-170
Broad ridges, cirque basin, benches	ash/pumice over gran/medimorph	Teneriffe Typic Haplorthods	90-130	44	5.4	130-160
Ridges and mountain side slopes	ash and loess over colluv/dense till	Kindy				
Ridge crest and mountain slopes	orstein Andic Duricryod	75-90	43	5	90-120	1800-3000

* MAT = mean annual temperature

3.6.3 Environmental Consequences

3.6.3.1 Spatial and Temporal Context for Effects Analysis

The analysis area for direct, indirect, and cumulative effects on the soil resource is the treatment analysis areas that include the currently known sites along with areas of expected spread (road and stream corridors). Treatment of new sites may occur anywhere on the Forest.

The project duration is approximately 10 to 15 years. Repeated treatments of manual, mechanical or chemical methods may be necessary in the same year or sequentially. Effects may last up to 10 years depending on degree of soil disturbance or persistence of various chemical herbicides. The proposed action also provides for treatment of new infestations or changes to existing infestations during the life of the project.

3.6.3.2 Direct and Indirect Effects from Alternative 1 – No-Action Alternative

Effects on Soil Organisms

No long-term adverse effects on soil organisms would result from Alternative 1. The effects of the herbicide applications were analyzed for the soil resource in the MBS 2005 DN and the 2008 MBS supplemental information report and determined to meet a Finding of No Significant Impact for soils. Similarly, rates of herbicide application are within the range analyzed and approved in the R6 2005 ROD.

No adverse effects to soil biological organisms are associated with the use of herbicides under No Action (SERA 2004b, 2011b, 2011d). Soil microbes are the primary degradation pathway for these herbicides by metabolic decomposition (Anderson and Dulka 1985, Bollag and Liu 1990, Radcliff et al. 2006, Gish et al. 2007, also see SERA 2004b, 2011b, 2011d).

Vegetation Cover *and Erosion*

Ongoing manual treatments may lead to small soil disturbance from wrenching invasive plants. Typical treatments result in less than 1 square foot loosened soil. Extracting Scotch broom, Himalayan blackberry and butterfly bush may lead to larger disturbance up to 2.5 square feet. These disturbances do not adversely affect overall site productive capacity since they are small and distributed, and do not lead to substantial soil loss. The retained cover of target plant species curtails erosion of loosened soil. Bare soils usually remain below 10 percent areal extent for a treatment site.

Changes to Plant and Soil Communities

Alternative 1 would indirectly affect soils since treatments would not be as effective as the action alternatives. Ground disturbance in close proximity to already infested ground has high risk for invasive plant spread. Isolated populations of invasive plants can quickly spread onto adjoining forest lands where the forest canopy is opened up. Seeds of invasive plants can be carried some distance by wind, animals, equipment, or even on clothing and shoes. In the absence of effective treatments, invasive weed populations would continue to grow along main travel corridors and increase spread risk onto adjacent forestland where disturbed.

Invasive plant colonization of disturbed soil would not directly lower soil productivity, but potentially shift the composition of soil organisms and perpetuate early successional conditions. Invasive plants can slow plant community development into late seral plants on disturbed ground, which interferes with the expected recovery within plantations and other managed areas.

Most of the MBS invasive plants are forbs or vines that cover large areas quickly and lessen the diversity of native grasses and forbs. Changes away from natural plant communities are accompanied by changes in the soil communities (Wardle et al. 2004, Wolfe and Klironomos 2005). Research in the Northeast US shows a general tendency for invasive plants to increase the available nitrogen in soil and produce litter that's easier to decompose, shifting the nutrient availability (Ehrenfield 2001, 2003). Since invasive plants do well in nutrient rich environments (Bashkin et al. 2003, James et al. 2010), then Ehrenfield's research demonstrates how invasive plants can perpetuate conditions that they thrive in. In contrast, natural forest communities have low available nitrogen (Hart et al. 2005), and rely on higher order fungal symbiotic relationships to access nutrients. Within the current invasive plant sites, changes away from the natural environment would be most substantial for the coniferous forest environments. MBS lands ceded from old pasturelands have already moved to a novel microbial community and thus undesired invasive plants have less potential to change these soil communities.

Soil Regulation of Offsite Herbicide Transport

A tradeoff of using herbicides is the potential risk for treating non-target vegetation from drift and runoff. Compact soils or engineered fill within campgrounds or along roads can induce herbicide runoff if a rainstorm occurs following treatment. Though dilute, adjacent non-target vegetation can receive herbicide laden runoff. Mitigation is in place from prior decisions to lower risk for runoff. A primary measure avoids treatment during wet periods and potential rainfall within the following 24 hours to substantially reduce offsite transport (SERA 2004b). Clopyralid has higher runoff potential and is effective at lower rates, while also having higher solubility. The risk drops dramatically with time since soils adsorb herbicide and decompose residues.

3.6.3.3 Direct and Indirect Effects from Alternatives 2 and 3

The effects of the action alternatives on soils are similar. The only difference between alternatives (use of aminopyralid or not) does not result in substantial differences in effects on soils. MR/MM minimize impact on soils regardless of herbicide choice.

Direct adverse effects from the selected herbicides and application rates are not expected for either action alternative. Impacts to soils and soil microbial community would largely be secondary, related to removal of targeted vegetation and shift to desired plant species. Indirect effects of herbicide runoff and leaching would be reduced by soil physical properties that adsorb herbicide residue and decrease surface wash, and the level of decomposition in soil to degrade herbicide concentrations. For the MBS, factors such as extent of groundcover, compactness of soil, slope percent, and the biological capacity of soil largely determine herbicide fate rather than soil type.

Direct Effects on Soil Organisms

The SERA Risk Assessments do not indicate that the proposed herbicides are toxic to the soil microbes at the rates proposed for use. The direct effect of herbicides on fungal and bacterial soil microorganisms vary with the herbicide used, and even then depend on the residue reaching the soil and the degradation rate, or half-life of the chemical. The effect to micro-organisms is usually not gauged by direct measurements, but inferred by changes in productivity factors such as respiration (CO_2 production), of which microbial activity is one cause (SERA 2003a). However, toxicity of herbicides to soil micro-organisms may be relevant only in the soil medium itself. Busse et al. (2001) showed that glyphosate, which can be toxic to microbes grown directly on the herbicide in the laboratory, had an unmeasurable effect on microbes when applied directly to soil in the laboratory or in the field. In a later study on glyphosate effects to soil microbial community structure, Ratcliff et al. (2006) showed a sizable increase in the bacteria to fungal ratio for the spill scenario (100% solution) and not for the diluted field rate. The increase may be only temporary as bacteria metabolize the herbicide, a labile carbon source, with an anticipated return to normal composition as the active carbon supply returns to natural levels.

Of the 10 herbicides approved in the R6 2005 ROD, picloram and sulfometuron methyl were noted to have potential affects to soil microbes in laboratory tests but not in field studies (R6 2005 FEIS). The action alternatives reduce these risks by limiting frequency and rate of application. Thus, impacts to the soil microbial community would largely be indirect, related to removal of targeted vegetation and shift to desired plant species. Indirect boosts in decomposition rates may result as soil microbes metabolize dead plant tissue. Slight increases in microbial activity may occur as the bacteria break down the herbicide.

The SERA risk assessments identified potential short term decreases in select soil microbes for picloram, imazapyr, metsulfuron methyl, and sulfometuron methyl that could occur for higher rate applications than the action alternatives propose. The effects were reported from laboratory assays using soil concentrations above the amounts expected in soils given the low application rates and the Forest's abundant rainfall. The herbicides effects decrease with time as other microbes, less sensitive to herbicide, decompose the active ingredient. Table 40 contrasts the microbial decomposition of each herbicide using half-life. Persistent herbicides such as picloram have longer half-lives. Impacts to microbes would be least where soils have a high degree of productive capacity with adequate organic matter, aeration and moisture.

Aminopyralid may be used in Alternative 2. The 2007 SERA Risk Assessment does not indicate any risk to soil microbes. However, aminopyralid has a very wide range half-life of 14-343 days as reported in the SERA Risk Assessment. Due to plausible persistence from slow microbial decomposition, the project has limited broadcast spray to once a year (MR/MM 26). Aminopyralid readily breaks down in sunlight with a half-life of 61 days (Table 40). The half-life drops dramatically to less than 1 day when exposed to water and sunlight, but extends up to 400 days when in groundwater.

For picloram, the SERA risk assessment cited a slight decrease in the N fixing bacteria Azotobactor for a 2-week period at picloram concentrations of 10 ppm (see Tu 1994). In general, laboratory assays found little detectible changes in microbial activity below 50 ppm soil concentrations (SERA 2011c). Within the SERA risk assessment, results from a groundwater loading effects model (GLEAMS) show that for the clay, loam and sandy soils the soil concentration after application would be below 10 ppm. GLEAMS modeling of picloram application on a MBS sandy-loam soil would result in 0.5 ppm picloram soil concentration following treatment. However, the SERA risk assessment indicated acid soils may decrease the decomposition rate. Given the acid soils across the MBS because of the abundant rainfall and spodosol soils, picloram may have slightly longer residence times. Two mitigation measures address the possible picloram buildup in soil. First, repeat applications would be limited to every other year (MR/MM 26). Second, picloram would not be used on poor soils where microbial decomposition is low (MR/MM 27).

For metsulfuron methyl, findings from one study showed slight growth reduction of common soil bacterium above 5 ppm (SERA 2004c). These effects increased with dosage. Modeled metsulfuron soil concentrations are 0.03 ppm. As with picloram and imazapyr, metsulfuron methyl is known to be persistent. The persistence may be desired as a pre-emergent to inhibit weed seeds within a growing season. However, evidence exists in agricultural studies that metsulfuron methyl can persist at high enough levels to damage the following year’s crops (Yu et al. 2005). Despite the persistence, one of the surprising findings of this study was the demonstrated ability of a fungus to rapidly detoxify metsulfuron methyl. On the MBS, the persistence of metsulfuron methyl would be lower than the SERA analysis since the maximum broadcast rates are less than a quarter the rate used in the SERA report. Furthermore, application would be limited to once every other year and avoid poor soils where decomposition rates are low (MR/MM 26, 27). This mitigation would prevent herbicide build-up in the soil.

Sulfometuron methyl was identified as potentially depressing soil microbial growth from laboratory studies (SERA 2004d). Other studies found both no effect and lower impacts to microbial biomass using herbicide concentrations near the rates evaluated in the SERA risk assessment. The risk assessment shows mixed results with uncertain effects to any particular microbial group. Since herbicide half-life indicates the decomposition and thus microbial activity, this provides some indication as to toxicity. Field studies demonstrate the half-life ranges from 10 to 100 days (SERA 2004d) with higher decomposition in humid climates (Anderson and Dulka 1985).

The use of sulfometuron methyl would not adversely affect soil microbes since the highest level of application is 0.2 lb. a.i./acre, which is half the rate evaluated in the SERA risk assessment where findings produced mixed results from the laboratory experiments. An environmental fate study of sulfometuron methyl showed that low concentrations in soil followed first order decay equations, suggesting that no depression of microbial activity was found (Anderson and Dulka 1985). Soil concentrations in the study were 0.14 ppm while modeled soil concentrations of sulfometuron methyl would be 0.03 ppm. The lower soil concentration would have even less potential of depressing microbial activity.

Imazapyr was shown to temporarily depress microbial activity, but again at application rates well above proposed rates (SERA 2011a, 2011d). Concentrations of imazapyr in the soil over 20 ppm were reported to slow cellulose decomposition by microbes (SERA 2011d). For the MBS, spraying imazapyr could lead to soil concentrations up to 0.3 ppm; far lower than the threshold of concern. The reported half-life of greater than 200 days indicates imazapyr may resist decomposition. As with other more persistent herbicides, the project avoids the use of imazapyr on poor soils and limits the frequency of broadcast application to once every other year (MR/MM 26 and 27).

Triclopyr has reportedly affected fungal and bacterial strains in soil, but at use rates above 10 times the intended rate (SERA 2011a). Some fungal strains had detectible changes to growth down to as little as 0.1 ppm herbicide soil concentrations. When testing natural soil samples, no detectible changes to microbial function or community structure was found for a rate of 1.2 lb. a.i./acre (Houston et al. 1998). The typical rate for triclopyr on the MBS is 1 lb./acre. Model runs using a high rate at 2 lb./acre show average soil concentrations of 0.4 ppm. At this concentration, triclopyr has very low potential for slowing fungal growth.

Table 40. Compiled herbicide properties for mobility in soil and water transport from SERA risk assessments

Herbicide	Toxicity to Soil Microbes[1]	Adsorption	Water Solubility (mg/l)	Degradation Half-Life (days)		
				Soil Microbes	Water and Sunlight	Ground-water
Aminopyralid	Low	Low	205,000 pH 7	14-343	0.6	127-447
Clopyralid	Low	Low	1,000	12-70	8-40	261
Chlorsulfuron	Low	Low; very low in clay soils	27,900 pH 7	120-180	Not Known	37-168
Glyphosate	Low	Strong	12,000	3-130	4-11	50-70
Imazapic	No info	Moderate	>2,670 mg/l	25-142	1-2	30
Imazapyr	Slight	Low	13,100	210-2154 (longest in anaerobic soils)	2-20, 325-500 in anaerobic conditions	325
Metsulfuron	Moderate for	Very low	2,790	120	1	1213

Herbicide	Toxicity to Soil Microbes[1]	Adsorption	Water Solubility (mg/l)	Degradation Half-Life (days)		
				Soil Microbes	Water and Sunlight	Ground-water
Methyl	high application rates on poor soils					
Picloram	Moderate for high application rates on poor soils	Very low	200,000	80 to 360	3-14	none
Sulfometuron Methyl	Low	Low	300	10-100	1-14	113
Triclopyr TEA (salt)	Low	Low	8,100 mg/l	14-46	2-6 hours	6 hours
Triclopyr BEE (ester)	Low	Moderate	7.4 mg/l	40	0.5-9	No data

[1] Reported temporary depressed effects to some microbial groups for imazapyr, metsulfuron methyl, picloram, sulfometuron methyl, and triclopyr. Categorical risk is assigned based on proposed use rate compared to laboratory studies outlined in the SERA risk assessments.

Vegetation Cover And Soil Erosion

Herbicide application temporarily disturbs soils by altering vegetation cover and reducing the annual plant production. The resultant decrease in vegetation cover could increase erosion potential with less vegetation canopy to intercept rainfall. Remaining stems and litter from treated plants and existing non vegetation would provide groundcover to counter erosion generation. The effect is low and temporary since most of the sites susceptible to erosion are administrative. Administrative sites such as roadsides and facilities have inherent erosion from compact, engineered surfaces that resist infiltration. The treatment of weeds on these sites would not likely increase erosion where designed to shed water. Treatment of forbs and vines within natural forest area would have retained grasses to counter against erosion. These targeted surfaces include skid trails, log landings and haul routes.

The action alternatives include non-herbicide treatments that generally would have the same risks and impacts as the No-Action Alternative. The action alternatives would allow for mechanical treatments such as mowing and string trimming would not result in soil disturbance. The action alternatives would also add another layer of protection against erosion from manual treatments by requiring seed and mulch for manual treatments within 35 feet of water courses. Passive and active restoration would also occur for selected areas (see Chapter 3.4 and the Botany Resource Report).

Changes to Plant and Soil Communities

Changes to soil biology from herbicide spraying could occur where plant community composition shifts. Dead decaying plant litter would increase microbial decomposition. Where desired plant species increase growth after treatment, an antecedent change in soil microbial community could occur.

Soil Regulation of Offsite Herbicide Transport

Risk for runoff and leaching is low since treatments generally occur during the dry season when about 15 percent of annual precipitation occurs. Since rain storms increase the risk for runoff, herbicide application is avoided if the forecast is for rain. A study by the USFS on road shoulder runoff found that risk for runoff is highest during the first day of rainfall (Wood 2001). Herbicide laden runoff decreases as herbicide adsorbs to vegetation and soils.

Risk for offsite transport of herbicide laden dust is very low from moist conditions on the MBS that lowers risk for wind transport.

Soil conditions on the MBS determine herbicide runoff and leaching more than soil type. Herbicide labels list soil texture as a main factor to consider for offsite spread, but the labels refer to agricultural settings that have extensive bare soil. However, for the typical application on MBS sites, the main factors that regulate herbicide movement include plant cover, groundcover, slope steepness and condition of the soil surface. Additional site factors that dictate herbicide transport are the degree of saturation and compaction. While soil properties such as texture relate to risk to leaching, in the montane setting leaching risks correspond more to the position in the valley bottom, and amount of rainfall that can transport herbicide residue downward along a wetting front.

The model runs for soils displayed in the SERA risk assessments demonstrate the low sensitivity to soil parameters. A sensitivity test was done to further investigate the influence of soil type on herbicide transport using a variety of soil textures and depths based on local soils data. These results showed that most of the offsite transport was controlled by runoff efficiency rather than soil type. Topography, resistance to infiltration from compaction or saturation, groundcover and plant interception of rainfall influenced runoff more strongly than soil type.

The highest runoff potential occurs on compact surfaces at forest administration sites and along roads. Sloped areas with thin soils and bedrock near the surface force lateral soil throughflow to the soil surface that then can produce runoff. Cut slopes along roads with rock faces and rocky thin soils on hill slopes are circumstances with high potential runoff. Outside of these disturbed or steep thin soil sites, most natural forested areas have well drained soils consisting of loam to loamy sand textures and high rock contents in excess of 35 percent that facilitate rapid drainage.

Saturated conditions also promote runoff found along valley bottoms and swales, most prominent following spring precipitation. Application in late spring could have higher risk for encountering saturated conditions after spring snowmelt. Management Requirements and Mitigation Measures (MR/MM) emphasize herbicide application during the driest conditions.

Valley bottom and alluvial fan areas that accumulate water draining from adjoining hill slopes have the highest potential for leaching. Heavy rainfall following spring would have a higher likelihood of transporting contaminants downward since moist antecedent conditions would facilitate percolation. Successive rainfall events that transport contaminants downward are rarer during the main period of treatment, June through September. The risk for downward percolation is highest for herbicides that have a higher residency time and are fairly stable in water. Picloram, imazapyr, and metsulfuron methyl have very slow decay rates once they move below the biologically active soil layer (Table 40). The application of these herbicides is limited to once every other year to limit risk for accumulating these herbicides in groundwater. Aminopyralid can have a moderately slow degradation rate and thus would be limited to one application per year to avoid buildup in groundwater.

GLEAMS modeling in the SERA risk assessments showed a relative drop in herbicide concentration as herbicides move down into the soil column with most retaining in the top 12 inches where biologic activity of decomposers are most active. Similarly, Forest Service monitoring for triclopyr and glyphosate in California found that most herbicide adsorbed and decayed in the active soil layer, towards the top (Bakke 2000). These findings also were reported by the California Department of Pesticide Regulation (Ganapathy 1997). Aminopyralid, though much less concentrated, can reach lower depths given its high solubility and low absorption (Table 40). Using the SERA assessments to compare the highly soluble herbicide aminopyralid with the less soluble glyphosate, concentrations of aminopyralid in soil were a magnitude lower than glyphosate. However, the SERA analysis predicted trace amounts of aminopyralid at depths below glyphosate.

GLEAMS modeling was done to study the movement of herbicides into the soil column assuming the maximum application rates for the project. Figure 4 displays the GLEAMS modeling results for a typical forest site. The results also showed the decrease in herbicide concentration with depth, similar to the SERA results. In the figure, dot size represents the concentration of herbicide – large dots correlate to higher concentration. Dot size does not directly correlate to effects on soil organisms or plants. For example, aminopyralid and clopyralid kill plants at lower concentrations than glyphosate or triclopyr. However, the relative drop in herbicide concentration with soil depth indicates a decrease in effect for an individual herbicide.

Figure 4 illustrates that most of the herbicides adsorb to soil within the top 20 inches, despite all having moderate to high solubility. Below 40 inches, only trace amounts remain. Amounts of aminopyralid are so small that they do not show up in the graph. The trace levels shown in Figure 4 for all of the herbicides are below detectible levels in the Forest Service field studies reported by Bakke (2000). The topsoil organics and mineral matrix bind the bulk of the herbicide in the top inches as reported in monitoring in California (ibid.).

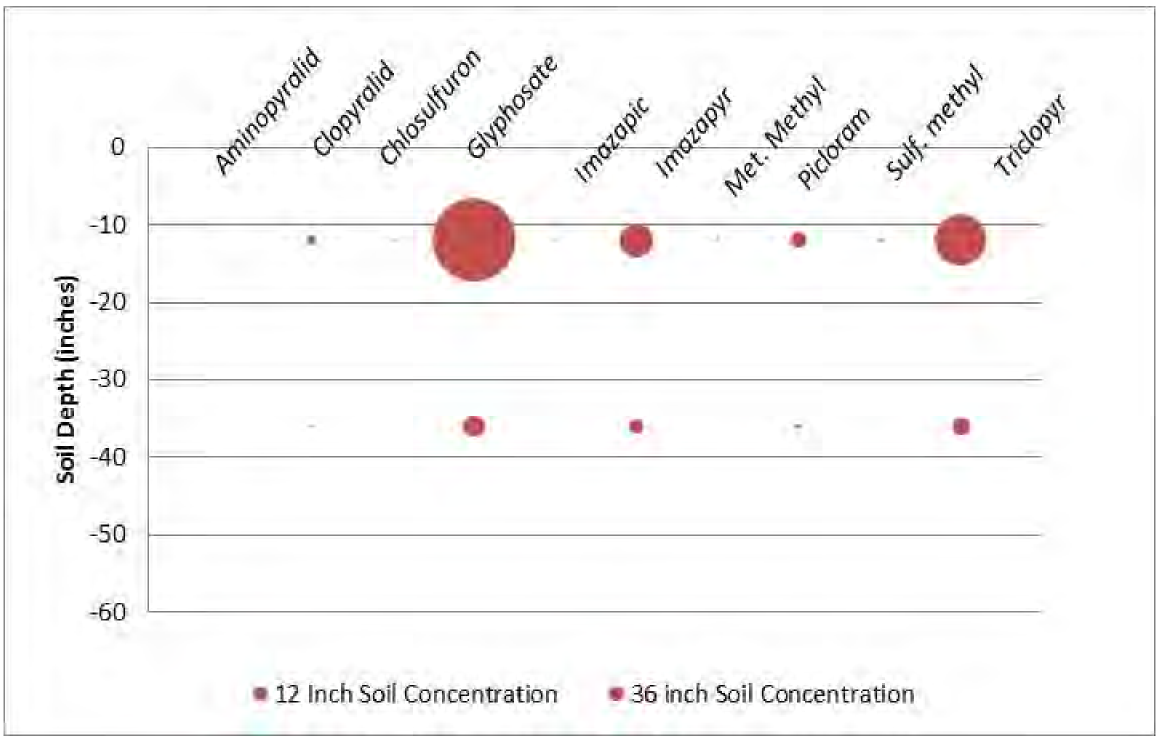

Figure 4. Relative Concentrations (ppb) For Proposed Herbicides in Soil Modeled for Forest Site with Wet and Cool Conditions

All the herbicides would have soil concentrations less than the levels of concern for drinking water in the upper soil and any leaching into groundwater would be minimal. Percolation of the more soluble herbicides could follow a wetting front—most common during spring and fall coinciding with the heaviest rainfall. The risk is low because herbicide treatment would be predominantly in summer during drier conditions when soils have less chance for leaching (MR/MM 7 and 27).

The action alternatives also reduces risk for herbicide buildup on low productivity sites that decay more slowly avoiding use of more persistent herbicides on bare or compacted surfaces (MR/MM 24). MR/MM 26 avoids use more than one application of imazapyr, metsulfuron methyl, or picloram on a given area in any two calendar years, except to treat areas missed during the initial application, and aminopyralid would not be broadcast in any area more than once per year. This also reduces the potential for herbicide build up in the soil.

Early Detection Rapid Response (EDRR)

The treatment analysis areas represent the range of environmental conditions expected on the MBS, thereby accounting for potential consequences. These conditions were used to analyze and produce MR/MMs that establish a sufficient layer of protection to limit offsite transport to non-target plants and groundwater. New or previously undiscovered infestations of invasive plants would be treated using the range of methods described in chapters 2 of the EIS, and in accordance with the MR/MM's.

EDRR (USDA 2003) is an essential component of the proposed action because the precise location of target plants is subject to change, and new infestations may grow substantially in area during the time taken to prepare new NEPA documents. The highest risk is for spread along infested roadways from disturbed roadways that provide open sites for weeds and high propagule pressure from passing traffic. The current use of project design measures and direct spray applications would limit offsite effect from runoff, erosion transport and leaching as outlined above.

3.6.3.4 Cumulative Effects of All Alternatives

The risk for additive effects from past and ongoing forest management activities is reduced since all alternatives retain the current prevention and restoration program. Recent past, ongoing and foreseeable future projects on the MBS could affect the soil resource. However, the contribution to potential cumulative effects from this project is very low because the extent, magnitude, and duration of the direct and indirect effects are low.

None of the alternatives would adversely affect soils or soil productivity. Thus, there is no potential for effects from the action alternatives to contribute to additive, synergistic, or other negative long term cumulative effects on soils.

Many of the recent past, current, ongoing and foreseeable future projects outlined in Appendix F create a very large disturbance footprint compared to the effects of invasive plant treatments. Recently completed projects on the MBS include closing and restoring roads; road construction, reconstruction and maintenance; vegetation management (mainly thinning); and recreation development and maintenance. These projects overlap with portions of TAA 4, 15, 19, 23, 26, 27, 41, 43, 44, and 45. The potential for cumulative effects would limited to areas where invasive plant treatment sites occur within or near the recently completed projects.

Projects that are currently being implemented or are ongoing on the MBS, include mining; a variety of recreation projects; road repair, closure, reconstruction/improvement, decommissioning and maintenance; stream restoration; and vegetation management (thinning and created openings). These projects overlap with portions of TAA 2, 3, 4, 5, 6, 11 15, 16, 17, 20, 23, 27, 30, 32, 33, 36, 41, 43, 45, 47, 49 and 53.

Foreseeable future projects include recreation and site maintenance; road closure, repair and reconstruction; vegetation management (mainly thinning and some created openings) and stream restoration. The projects could overlap with invasive plant treatments proposed in TAA 2, 4, 6, 11 14, 19, 23, 32, 33, 38, 32, 43, and 45. These projects may last for several years.

Some of these projects include heavy equipment operation that results in soil excavation, compaction and soil displacement. However, because there would be no detrimental disturbance[25] associated with invasive plant treatments, regardless of the disturbance footprint of overlapping projects, the low level of soil disturbance associated with invasive plant treatment would not contribute to cumulative detrimental disturbance. Invasive plant treatment would have very low disturbance since although live vegetation cover is reduced, ground cover would be conserved by retention of non-target species, litter and rock. The groundcover protects against erosion. Invasive plant treatment may temporarily depress native vegetation cover within some treatment sites, but the objective is to increase desired plant vegetation cover.

Administrative maintenance on roadways and facilities would have frequent overlap with invasive plant treatments due to the engineered surface that attracts noxious weed species and the propagule pressure from passing road traffic. Continued road management activities would have regular invasive plant treatment needs with ditch clearing and road blading that transplants or buries roadside vegetation. Current best management practices reduce this risk by promoting vegetative cover. Road maintenance best management practices reduce the bare soil along road sides by limiting the frequency (BMP Road-4, USDA 2012b) and establishing plant cover after construction and re-construction activities (BMP Road 3, USDA 2012b). The MBS's invasive plant prevention program further reduces risk for overlap of herbicide treatments with road maintenance activities and therefore any potential additive effects (see MBS 2005 Invasive Plants EA/DN Best Management Practices (USDA 2005c).

Administrative actions planned that would have one time actions that could interact with invasive plant treatments include rehabilitating a campground, removing river riprap and hydro- electric facilities, and replacing a utility line. These activities would follow prescriptions to prevent and rehabilitate the sites that decrease invasive plant presence. Initially, the actions may involve compacting and excavating soils to complete these projects. The overlap would be highest directly after the projects' completion, tailing off as vegetation recovers. Vegetation reductions from treating invasive plants would not result in compaction or heavy soil disturbance.

Treatment of invasive plants would beneficially affect recovery of native plant communities following vegetation and road management projects, and effective treatment would prevent invasive plants from diverting natural succession of understory species. Within the ongoing timber harvest sites, invasive plant treatments would be concentrated along skid trails and log landing sites (Birsall et al. 2011) where re-vegetation takes longer and weeds readily colonize. These areas typically result in detrimental disturbance and cover less than 20 percent of a harvest unit. Timber roads and log landings may remain a hazard for weeds to colonize for up to 10 years since these have a disturbed soil footprint. Decommissioned roads would also have high initial overlap with invasive plant treatments. Burn piles within timber harvest areas attract Canada thistle. Concentrated burning leaves alkaline conditions from the ash, along with abundant nutrients and open sites for the thistle to colonize (see Meyer et al. 2009).

[25] "Detrimental disturbance" is defined as management activities that physically alter soil and remove organic matter, to the extent that soil recovery remains very slow (USDA 1998). In contrast, "low disturbance" is defined as short term reductions to vegetation cover that lasts less than ten years (ibid.).

Forest actions with very low to negligible overlap include maintaining the high elevation ski areas and ongoing recreation use at wilderness trailheads and trails. These areas have very small infestations since their climate is outside the growth range of most of the listed invasive plants. The Mt. Baker, Stevens Pass, Snoqualmie Pass and Crystal Mountain ski areas have bare cut slopes from access roads along the open ski slopes with high erosion hazard, leaving barren open areas for invasive plant colonization. Despite the bare slopes, only one invasive plant site is recorded within these high elevation areas.

3.6.4 Consistency with Regulations, Policies and Plans

All alternatives comply with regulations, policies and plans related to protection of the soil resource.

3.7 Water Resources

3.7.1 Introduction

The effect of invasive plant treatment on soils and water is a primary public issue. Federal and state laws, policies and regulations control the use of herbicides on National Forest System (NFS) lands, including the Clean Water Act and the Federal Water Pollution Control Act. Section 208 of the 1972 amendments to the Federal Water Pollution Control Act (Public Law 92-500) specifically mandated identification and control of non-point source pollution. The Clean Water Act (1972) and Executive Orders 11988, 11990, and 12088 provide protection of water resources. Clean Water Act Section 303(d) directed the State of Washington to list Water Quality Limited Waterbodies (303(d) listed streams) and develop Total Maximum Daily Loads (TMDL) to control the non-point source pollutant causing loss of beneficial uses.

A National Pollutant Discharge Elimination System (NPDES) permit is required for herbicide use into water or adjacent conveyances with a hydrologic surface connection to water at the time of herbicide application to satisfy Section 402 of the Clean Water Act. This requirement applies to creeks, rivers, lakes, riparian areas, wetland, and other seasonally wet areas when water is present. MR/MM and buffers are intended to minimize any pollution discharge to the extent practicable, thus this project conforms to current pollution control requirements. This 2300-A general permit would be obtained annually when herbicide is used near surface waters (generally within 3 feet of waters of the state or within 3 feet of flowing ditches that are connected to the waters of the state (http://www.deq.state.or.us/wq/wqpermit/indinfo.htm)).

The MBS National Forest Plan (USDA 1990, amended by the 1994 Northwest Forest Plan ROD and by the R6 2005 ROD for invasive plants) provides direction to protect and manage resources on NFS lands. Additional scientific guidance and background information is available within various Watershed Assessments and the General Water Quality Best Management Practices (1988). The Water Resources Specialist Report is incorporated by reference in its entirety.

Waters on the MBS are considered extraordinary under State of Washington 173-201A-600 list. Beneficial uses for these waters include:

- Core summer salmonid habitat
- Salmonid migration, rearing, spawning, and harvesting.
- Water Supply (Domestic, Industrial, Agricultural)
- Stock Watering
- Commerce and Navigation
- Wildlife habitat
- Recreation (Extraordinary primary contact)

§ Fish harvesting

The proposed herbicide use in Alternatives 2 and 3 would be done according to State and Federal laws, EPA label requirements, SERA Risk Assessments, and standards in the R6 2005 ROD. Site-specific mitigation measures would further minimize or eliminate the risks and effects of herbicide applications to water resources.

3.7.2 Affected Environment

3.7.2.1 Watersheds

Watersheds are natural divisions of the landscape and the basic functioning unit of the hydrologic system. Watersheds are hierarchical – smaller ones nested within larger ones. Environmental changes commonly accumulate and appear on a watershed basis. For the purpose of analyzing and summarizing aquatic and vegetative data a hierarchy of watersheds and watershed boundaries was developed by the region using U.S. Geological Survey (USGS) protocols. The MBS is entirely located within the Puget Sound basin, which represents the largest type of watershed in the hierarchy. The headwaters begin along the Cascade Mountains and all water drains down through several watersheds to ultimately be released into the Puget Sound, which represents the beginning of the Pacific Ocean with its saline waters and estuaries. While the general flow pattern through these watersheds is from east to the Puget Sound in the west, there are more finite intricacies of smaller watersheds that vary greatly in terms of geology and geomorphic processes. At least one treatment analysis area is mapped within every HUC-10 (10 digit hydrological units) watershed on the MBS.

Table 41 shows the estimated infested acres within each watershed located in the MBS and the estimated infested acres within aquatic influence zones. The aquatic influence zone is roughly approximated by half the distance of a riparian reserve (defined in the Northwest Forest Plan), which vary in width between 50 foot adjacent to small, intermittent channels and up to over 200 feet in areas of large trees adjacent to fish-bearing waters. Treatment within aquatic influence zones present the highest risk of delivery of sediment and other contaminants.

An estimated 53 percent of the infested acreage lies within riparian reserves and 34 percent are located within aquatic influence zones. Watershed analyses were conducted between 1995 and 2009 for all watersheds on the forest, and these documents were reviewed so that recommendations regarding invasive plants were considered in the design of this project.

Table 41. Estimated Infested Acres in HUC-10 Watersheds

HUC-10 Watershed Number	HUC-10 Watershed Name	No. of HUC 12 Sub-Watersheds Containing Treatment Analysis Areas	Estimated Infested Acres	Estimated Infested Acres Within Aquatic Influence Zones
1711000101	Upper Chilliwack River	1	0	0
1711000102	Middle Chilliwack River	1	0	0
1711000401	Upper North Fork Nooksack River	7	233	213
1711000403	Middle Fork Nooksack River	1	0	0
1711000404	South Fork Nooksack River	2	0	0
1711000505	Diobsud Creek-Skagit River	4	9	1
1711000506	Cascade River	2	7	3
1711000507	Baker River	6	9	5

HUC-10 Watershed Number	HUC-10 Watershed Name	No. of HUC 12 Sub-Watersheds Containing Treatment Analysis Areas	Estimated Infested Acres	Estimated Infested Acres Within Aquatic Influence Zones
1711000508	Illabot Creek-Skagit River	4	63	7
1711000601	Upper Sauk River	4	330	246
1711000602	Upper Suiattle River	4	0.2	0
1711000603	Lower Suiattle River	6	235	16
1711000604	Lower Sauk River	6	393	268
1711000701	Finney Creek-Skagit River	4	361	32
1711000801	North Fork Stillaguamish River	6	74	14
1711000802	South Fork Stillaguamish River	6	435	127
1711000901	Tye River	5	156	34
1711000902	Beckler River	3	167	41
1711000903	South Fork Skykomish River	4	309	56
1711000904	North Fork Skykomish River	4	41	20
1711000905	Sultan River	2	1	0.4
1711000906	Wallace River-Skykomish River	1	0.1	0.1
1711000907	Woods Creek-Skykomish River	1	0	0
1711001001	North Fork Snoqualmie River	1	0	0
1711001002	Middle Fork Snoqualmie River	5	119	61
1711001003	South Fork Snoqualmie River	3	114	25
1711001004	Upper Snoqualmie River	1	50	0
1711001005	Tolt River	1	0	0
1711001101	Pilchuck River	2	0	0
1711001201	Cedar River	2	0	0
1711001301	Upper Green River	4	20	7
1711001302	Middle Green River	1	0	0
1711001401	Carbon River	3	3	0.2
1711001402	Upper Puyallup River	2	0	0
1711001403	Upper White River	8	774	168
1711001404	Lower White River	2	0	0
Totals		**119**	**3,903**[1]	**1,347**

[1]About 978 acres include more than one invasive plant target species; target species would be treated together where possible.

3.7.2.2 Climate and Precipitation

The climate of the northern Cascades is cool and relatively dry summers, mild and wet winters. The driest months are July and August, which may have only a few inches or less recorded rain. Winter months on the other hand may average over 20 inches. Snowfall is light in the lower elevations and heavy in the mountains (WRCC 2012). The precipitation map shown in Figure 4 displays the rainfall averages in the northern Cascades, at 60 to 120 inches per year with relatively uniform gradients (WRCC website). The low lands lying between the Forest and Puget Sound is in the rain shadow of the Olympic Peninsula, and average precipitation is as low as 30 inches or less.

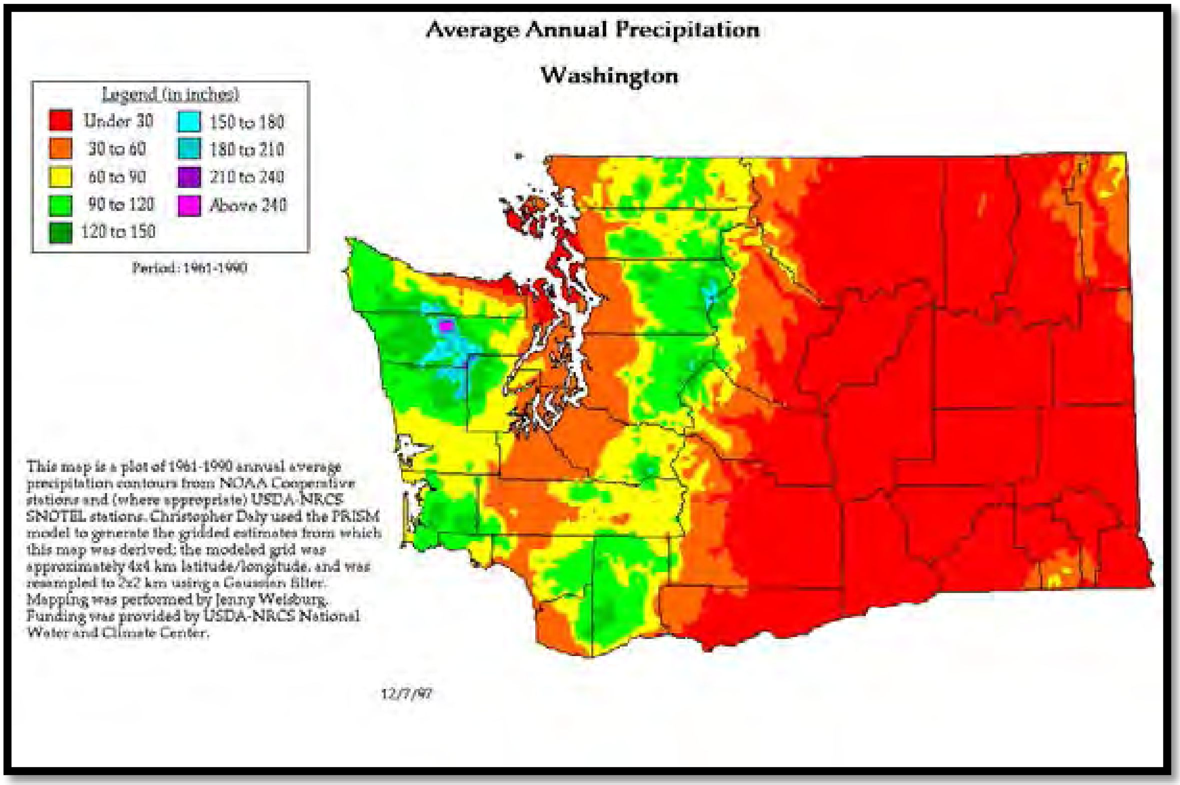

Figure 5. Precipitation map of Washington State

3.7.2.3 Stream Flow

Daily stream flow from three gages[26] located below the MBS with overlapping records and no diversions or impoundments are shown in Figure 5. In recent decades, the number of stream gage sites has been reduced; in many watersheds only those measuring streams with impounded or diverted flow remain operational. For these reasons the years of record shown in the figure are water years 1965-1969. The watersheds above the gages are succeeding orders of magnitude—7, 68 and 540 square miles, respectively for Hancock Creek, North Fork of the Snoqualmie River and the North Fork Nooksack River. Each flows through areas of predominately different rock types. Despite these differences in geology and scale the streams responses to precipitation events are very similar suggesting steep terrain and the

[26] Note: Nooksack is 538 square miles, NF Snoqualmie and Hancock, 68 and 7.3 square miles, respectively. Rock type for each, noted in map legend, is predominate for the watershed.

proximity of steep terrain to the gage sites are the most significant factors in runoff, from large 4th and 5th order stems to local scale of first and second order channels forming a headwater source.

Response to precipitation events from the various scale watersheds is close in time, and between them nearly identical, with increasing lag between the event and the gage site with increasing watershed size. However, the overall pattern is also nearly identical. A short "dry" season is typically June—September, with relatively more widely spaced and smaller rainfall. Stream flow drops off steadily toward a base flow condition by August, where streams are maintained by groundwater flow by gravity influence alone. In the fall, more frequent rainfall quickly "ramps" up stream flow as soil moisture increases. Infiltrating precipitation from each succeeding storm builds depth of water stored in the soil, creating a pressure head that drives water downward in the soil column until an impeding layer is reach. In low gradient areas, valley bottoms, or where underlying rock strata may be horizontal, a water table aquifer is built. On hill slopes where soils are typically shallow, the impeding layer is usually the underlying bedrock. Depending on amount of fracturing water may either percolate into rock members or flow parallel to bedrock surface. A mid-winter dip in stream flow occurs January—March, probably because precipitation at higher elevations is snow, held there until air temperatures warm.

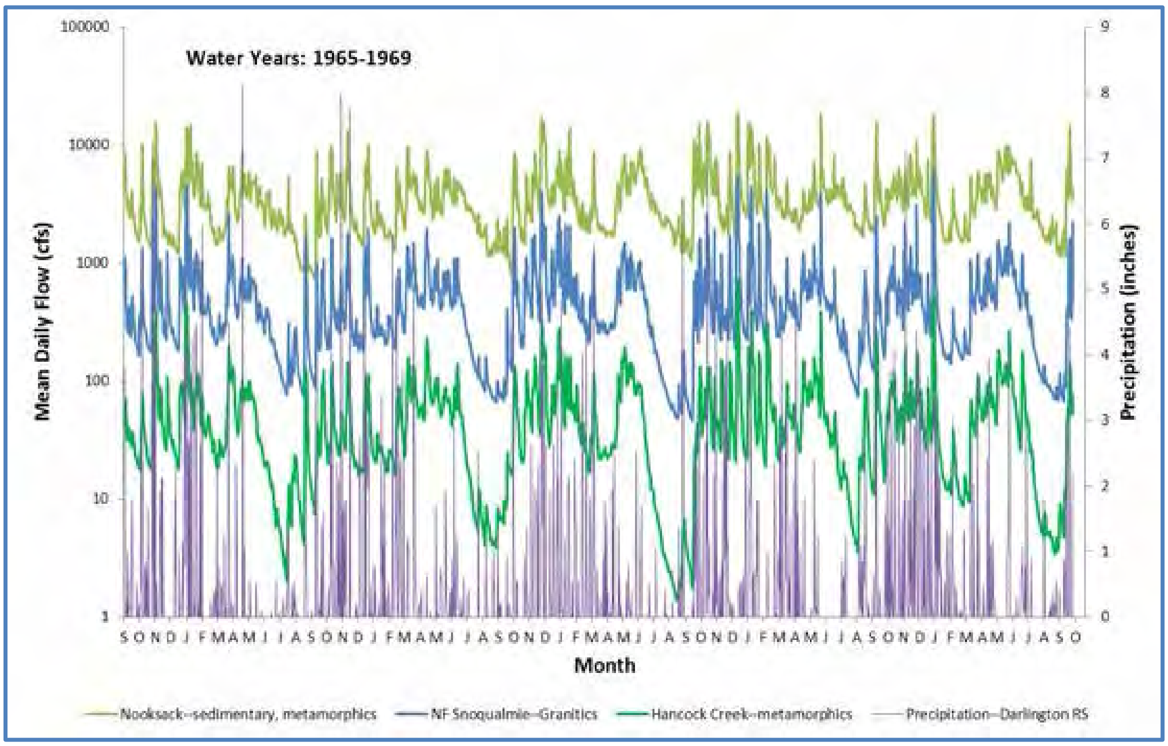

Figure 6. Mean daily flow for Three Gages

3.7.2.4 Water Quality Parameters

The primary water quality parameters that are assessed in this analysis are those parameters that may be directly and/or indirectly influenced by invasive plant treatments at any location across the forest, which are water temperature, stream turbidity, and the water chemistry parameters of pH and dissolved oxygen. These parameters are used as an analysis measure to compare and contrast the effects among the alternatives within the document. The analysis of the potential for alternative treatments to affect plants, animals, and humans is not located in the water resources chapter but can be found elsewhere in this document.

The objective of the Clean Water Act (CWA) is to restore and maintain the chemical, physical, and biological integrity of all waters. The Forest Service responsibilities under the Clean Water Act are defined in a 2000 Memorandum of Agreement (MOA) between Washington Department of Ecology and the Forest Service. The MOA designates the Forest Service as management agency for the State on National Forest System Lands.

Approximately 17,650 miles of streams flow on the Forest. Approximately 30 percent are perennial and 70 percent are intermittent. Section 303(d) of the Clean Water Act requires a list be developed of all impaired or threatened waters within each state. The Washington State 303(d) list of water quality limited streams identifies segments of 6 streams on the Forest as being impaired as of 2008, most of which are listed for temperature (Table 42).

Table 42. MBS water bodies listed as impaired under 303(d) of the Clean Water Act

Water Bodies Listed as Impaired Under Section 303(d) of the Clean Water Act	
Clearwater River	Temperature
Dorothy Lake	Dioxin
Gallup Creek	Temperature
Huckleberry Creek	Temperature
North fork Nooksack River	Fine Sediment
South fork Nooksack River	Temperature
Skagit River	Temperature
Summit Lake	pH

While no streams within the project area are listed due to chemical contaminants, Dorothy Lake is listed for a chemical contaminant (dioxin) that was found in the tissues of brook trout in 2000[27] . The source of the dioxins is unknown. Brook trout are not native to the area and the fish found in Dorothy Lake were most likely stocked there when it served as a fish hatchery.

The 303(d) list also includes Summit Lake for decreasing pH due to acid rain loading[28] (pH is a measure of the hydrogen ion activity in water). It is controlled naturally by the carbonate system consisting of carbon dioxide, carbonic acid, bicarbonate ions, and carbonate ions. It is a very important factor in the chemical and biological systems of water because of its role in affecting the degree of dissociation of weak acids and bases and therefore, the toxicity of many compounds and nutrient availability. It concentrations in streams vary seasonally and during the day due to biological activity. The Washington State water quality standard for pH is 6.5 to 8.5. A pH range of 6.0 to 9.0 appears to provide protection for the life of freshwater fish and bottom dwelling invertebrates; pH concentrations outside this range can affect fish and other aquatic organisms by allowing acids or bases to penetrate external membranes causing physiological stresses (KY Water Watch 2005). The listing of Summit Lake is due to pH values less than 6.5. These values have been attributed to acid rain conditions that result from coal burning power plants (USDA Forest Service 1998).

The Washington Department of Ecology (WADOE) is responsible for compiling the 303(d) list, assessing data, and submitting the 303(d) list to the Environmental Protection Agency (EPA) for federal approval.

[27] Study can be found at http://water.epa.gov/scitech/swguidance/fishstudies/results.cfm
[28] Eilers et al. (1996) documented sensitivity to acid rain loading. pH has steadily declined from 5.92 in 1985 to 5.30 in 1995 and 1996.

WADOE and EPA typically develop a Total Maximum Daily Load (TMDL) and a Water Quality Restoration Plan (WQRP) for 303(d) listed water bodies. The TMDL and WQRP address a value of the maximum amount of a pollutant that a body of water can receive while still meeting water quality standards. WQRP's (including TMDL's) have been prepared for Sediment and Stream Temperature in the Upper White River (WADOE 2003, WADOE 2007) and for Temperature in the Stillaguamish River Basin (WADOE 2004, WADOE 2006). WADOE is just beginning the development of a Temperature TMDL in the Skykomish River watershed, and EPA is developing a Temperature TMDL for all NFS lands within Western Washington that would protect and restore water temperature conditions in streams

3.7.2.5 Water Temperature

The majority of the streams listed as impaired under Section 303(d) of the Clean Water Act within the Mt. Baker-Snoqualmie National Forest are listed for temperature. Water temperature is an important factor which influences aquatic productivity. Temperature changes may result from natural climatic conditions, surface water - groundwater interactions, or human manipulation of in-stream flow and the riparian environment. Water temperature is a function of flow, surface area, solar input, air temperature, and other variables. Physiological stress in fish would increase as temperatures increase (Beschta 1997).

The State standard applicable to water ways within or adjacent to the project area is a floating 7-day maximum average of 16.0 ˚C and for bull trout spawning and juvenile rearing 12.0 ˚C.

3.7.2.6 Sediment and Turbidity

Suspended sediment is a measure of suspended sand, silt, clay and organic matter which settle to the stream bottom. Sediment may adversely affect fish by filling in pools, reducing bottom fauna, and silting in spawning gravels. Sediment delivery to streams is dependent on the degree of soil erosion, slope, distance to a stream, amount of exposed soil (effective ground cover), and intensity and continuity of disturbance. Invasive plant sites have been found to be more susceptible to erosion than native vegetation (Lacey, Marlow, & Lane 1998), although this effect has not been observed in the project area specifically.

Turbidity is the measure of the ability of light to pass through water. Changes in turbidity may be due to the presence of suspended matter such as clay, silt, organic debris, plankton, various effluents. Excessive turbidity reduces light penetration into water and therefore, reduces photosynthesis by phytoplankton, algae, and submerged vegetation. Turbidity is often used as a surrogate to indicate changes in suspended sediment.

State water quality standards applicable to all water ways on NFS lands are established under WAC 173-201A-200 (1)(e) that directs that turbidity levels should not exceed background levels by 5 "nephelometric turbidity units" (NTU) when the background is less 50 NTU or less or no more than 10 percent when the background turbidity is more than 50 NTU. There can be a close correlation between turbidity and suspended sediment in a given stream, but this correlation may change as organic material increases over the summer or if the percent of sediment from different sources in the drainage changes. Turbidity does not measure the amount of sediment being transported as bed load. There is no state quantitative standard for suspended sediment, bed load, or total sediment. When streams repeatedly exceed state water quality standards for turbidity or other water quality parameters, they become listed as impaired water under Section 303(d) of the Clean Water Act. As of the 2008, the North Fork Nooksack River is the only stream listed as impaired for fine sediment under Section 303(d) of the Clean Water Act (WADOE 2012).

3.7.2.7 Municipal Watersheds and Domestic Water Supplies

Ten municipal watersheds are either located within the MBS or capture water that drains off the forest (Table 43). Herbicide use within all municipal watersheds would be coordinated with watershed managers.

Approximately 22 acres are currently infested with invasive plants within municipal watersheds, primarily along roads and within other disturbed areas (quarries, campsites). None of the infested sites are within 1,000 feet of any water intake.

In addition to the municipal watersheds, special use permits for several surface water intakes are on file for individual homes. There are approximately six small water supply systems on the Forest that are supplied from well water; the largest of which serves approximately 7,500 people annually at the Alpental Ski Area, as well as one small spring that is supplied to the town of Index. All campgrounds use wells as water sources.

Table 43. Acres of invasive plants in municipal watersheds on the MBS

Municipal Watershed Name	Infested Acres	Water Source
Alta Crystal Resort	0	Deep Creek (tributary to White River)
Bellingham	0	Middle Fork Nooksack River
Buckley	0	South Prairie Creek
City of Seattle	0	South fork Tolt River
City of Tacoma	20.1	Green River
Crystal Mountain Ski Area	0	Elizabeth Creek
Everett	1.5	Sultan River
Mt. Baker Ski Area	0	Razor Hone Creek
Scenic (UNINCORPORATED)	0	Scenic Creek
Stevens Pass	0	Tye River
Total infested acres	**21.6**	

3.7.2.8 Aquatic Conservation Strategy

The Aquatic Conservation Strategy (ACS) is an integral part of the 1994 Northwest Forest Plan. The ACS was developed to restore and maintain the ecological health of watersheds and aquatic ecosystems within public lands. The ACS is intended to meet several objectives toward meeting the goal of healthy ecosystems and watersheds. Aquatic Conservation Strategy Objectives are applied over time at site-scale, watershed-scale, and broader scales. Effects from invasive plants were considered along with effects from treatment. More information about the Aquatic Conservation Strategy is in Chapter 3.8.

Key Watersheds

The Aquatic Conservation Strategy also established a system of Key Watersheds to protect areas of high water quality and habitat for wild fish populations. Key Watersheds are intended to serve as refugia for at risk stocks of native and anadromous fish. Activities to protect and restore aquatic habitat in Key Watersheds are higher priority than similar activities in other watersheds.

Number of known sites and existing estimated acreage of invasive plants within key watersheds on the MBS are listed in Table 44. About 73 percent of the invasive plant sites are within Key Watersheds, and the spatial extent of these sites add up to about 0.4 percent of the Key Watershed areas.

Table 44. Number of sites and acres of invasive plants in Key Watersheds

Key Watersheds	Total Watershed Area (Acres)	Spatial extent of Inventoried Invasive Plant Sites (Acres)	Number of Inventoried Invasive Plant Sites
North Fork Nooksack River	103,718	604	32
South Fork Nooksack River	22,176	0	0
Deer Creek	22,602	47	6
North Fork Stillaguamish River	51,857	16	6
Suiattle River	207,297	218	47
Sauk River	201,003	1,137	73
South Fork Stillaguamish River	84,066	433	29
Skykomish River	323,104	1,034	168
White River	103,395	771	294
Middle Fork Snoqualmie River	88,538	134	36
Total	**1,207,755**	**4,394**	**691**

Invasive Plant Species in Riparian Reserves

Native riparian vegetation plays a key role in forming aquatic habitat for fish and other aquatic species. The roots of native vegetation help stabilize stream banks; the forest canopy provides large wood and protects streams from solar radiation in the summer. Invasive plants in riparian areas can cause a loss of functional riparian communities, loss of rooting strength and protection against erosion, and subsequent impacts on water quality (Donaldson 1997).

Table 45 displays the estimated infested acres, by treatment analysis area (TAA), located within riparian reserves and aquatic influence zones. The aquatic influence zone is used to highlight the areas where treatment is more likely to risk of delivery of sediment and other contaminants than upslope areas.

Treatment analysis areas range from fewer than 10 acres (distinct invasive plant population) to more than 3,300 acres (roadsides or stream banks). The average size of a TAA is about 570 acres. Riparian reserves are estimated to average 41 percent of TAA acreage, and about half the acreage of invasive plants are in riparian reserves. Currently, invasive plants cover an average of 16 percent of each TAA, scattered within riparian and upland areas.

Table 45. Estimated infested acres by Treatment Analysis Area and in Riparian Reserves

Treatment Analysis Area ID	Treatment Area Name	Total Treatment Analysis Area Acres	Treatment Analysis Area Acres in Riparian Reserves	Estimated Infested Acres	Estimated Infested Acres in Riparian Reserves
TAA_01	Evans Creek	420	96	3	< 1 acre
TAA_02	W. Fork White River	923	360	68	39
TAA_03	Greenwater River	1,611	664	396	221
TAA_04	The Dalles	598	156	295	59
TAA_05	Ranger Creek	166	72	15	2
TAA_06	Crystal Mountain Blvd	179	106	< 1 acre	< 1 acre

Treatment Analysis Area ID	Treatment Area Name	Total Treatment Analysis Area Acres	Treatment Analysis Area Acres in Riparian Reserves	Estimated Infested Acres	Estimated Infested Acres in Riparian Reserves
TAA_07	Sunday Creek	271	183	14	12
TAA_08	Road 52	58	37	6	4
TAA_11	I-90 Corridor King	1,967	1,145	86	62.
TAA_12	Middle Fork Snoqualmie River	644	532	119	107
TAA_13	Bessemer Road System	76	30	< 1 acre	< 1 acre
TAA_14	Snoqualmie Point	53	0	50	0
TAA_15	Martin Creek-Tye River	429	227	45	17
TAA_16	Lower Beckler River	761	305	157	84
TAA_17	Upper Beckler River	183	50	9	1
TAA_18	Rapid River	74	59	< 1 acre	< 1 acre
TAA_19	North Fork Skykomish River	658	419	41	31
TAA_20	Highway 2 Corridor & Miller River	1,000	510	283	127
TAA_21	Money Creek	89	73	26	20
TAA_22	Sultan River	170	53	1	< 1 acre
TAA_23	South Fork Stillaguamish River	1,124	586	438	231
TAA_24	Fall Creek	382	332	327	315
TAA_25	Sauk-Whitechuck Confluence	3	1	< 1 acre	< 1 acre
TAA_26	White Chuck River Road 23	205	146	3	2
TAA_27	Darrington South	1,502	812	352	309
TAA_28	Squire Creek	37	26	< 1 acre	< 1 acre
TAA_29	Sauk Prairie	214	100	18	6
TAA_30	Dan Creek	180	45	6	< 1 acre
TAA_31	Prairie Mountain	194	43	3	< 1 acre
TAA_32	Circle Creek-Suiattle	518	207	125	32
TAA_33	Big Creek-Tenas Creek	731	188	107	27
TAA_34	Segelsen Pass Road 18	393	154	72	29
TAA_36	Sedro Woolley	3,373	306	229	3
TAA_37	Crevice Creek	255	99	< 1 acre	< 1 acre
TAA_38	Finney Creek	1,478	652	131	53
TAA_39	South of Rockport	180	132	15	8
TAA_40	Concrete to Rockport	929	295	64	17
TAA_41	Suiattle Mountain	64	20	< 1 acre	< 1 acre
TAA_43	Baker Lake	1,906	476	9	7
TAA_44	Glacier Creek Rd 39	126	48	1	< 1 acre
TAA_45	Mt. Baker Highway 542	951	517	2310	220
TAA_46	Canyon Creek	165	71	20	1

Treatment Analysis Area ID	Treatment Area Name	Total Treatment Analysis Area Acres	Treatment Analysis Area Acres in Riparian Reserves	Estimated Infested Acres	Estimated Infested Acres in Riparian Reserves
TAA_47	Monte Cristo Townsite	110	52	< 1 acre	< 1 acre
TAA_48	South of Dan Creek	102	28	< 1 acre	< 1 acre
TAA_49	Tonga Ridge	417	147	1110	71
TAA_50	North Bend compound	28	0	280	< 1 acre
TAA_51	Diobsud Creek	2,143	820	90	5
TAA_52	Marblemount Boat	49	24	70	4
TAA_53	Sulphur Creek	146	108	< 1 acre	< 1 acre
TAA_54	Johnson Ridge	50	2	0	0
Totals		**28,286**	**11,514**	**3,906**	**2,128**

The following treatment analysis areas have infestations that cover more than 10 percent of their riparian reserve acreage: TAA 2, 3, 4, 8, 12, 16, 20, 21, 23, 24, 27, 32, 33, 34, 45, 49, 52, and 54. TAA 3, 12, 20, 23, 24, 27 and 45 have greater than 100 acres of infestation within riparian reserves (TAA 24 has 315 acres, the greatest amount of all the TAAs).

3.7.2.9 Roads Having Higher Potential for Herbicide Delivery

Roads are the primary conduit for invasive plants to enter the forest. The R6 2005 FEIS describes roadside ditches as an herbicide delivery mechanism; potentially posing a higher risk of herbicides reaching concentrations of concern for listed aquatic species. Ditches may function as an intermittent or perennial stream, extending the stream network. Roadside ditches can act as delivery routes or intermittent streams during high rainfalls or as settling ponds following rainfall events.

GIS was used to identify roads that pose higher risk to fish-bearing streams. Roads located within valley bottoms and within 200 feet of fish-bearing streams are considered to pose the highest threat from herbicide delivery from herbicide use within the road prism (includes cut and fill slopes). A map and list of these roads is in Appendix D. Approximately 1,217 acres (about 30 percent of the infested sites) lie within 25 feet of these roads.

Invasive plants are most common along roads, within compacted ditch lines, disturbed soil and thin soils near exposed bedrock. Roadside soils are assumed to function with a high runoff rate due to compaction.

3.7.3 Environmental Consequences

3.7.3.1 Introduction

The effects analysis is tiered to R6 2005 FEIS for quantitative information related to potential concentrations of herbicides in water (except for aminopyralid, which is addressed in the SERA Risk Assessment and discussed herein). The analysis is focused on expected effects within treatment analysis areas.

3.7.3.2 Treatment Methods Near Water

The treatments proposed within the aquatic influence zone are expected to have the most effects on water resources. Approximately 1,354 acres are currently infested within aquatic influence zones. As described in the alternative descriptions of Chapter 2, a “first year/first choice” treatment is proposed for all currently infested acres throughout the project area, and a summary of these treatments and their relative distribution and difference between alternatives can help provide context to the potential effects of the alternatives. Nearly all of the first year/first choice treatments involve herbicide use.

Approximately 67 percent of proposed first year/first choice treatments within aquatic influence zones are the same in all alternatives, including No Action. These treatments are found in Table 46. In all alternatives, aquatic formulations of imazapyr and glyphosate may be spot treated up to the waterline of perennial water bodies and within dry or intermittent stream channels if water is not present.

Table 46. "First Choice" treatments common to all alternatives within the Aquatic Influence Zones

"First Choice" Treatment in all Alternatives	Infested Acres to be Treated within Aquatic Influence Zones (acres)	Percent of all Currently Infested Acres within Aquatic Influence Zones
Imazapyr/glyphosate	727.2	54
Glyphosate	170.1	13
Hand-pull	8.9	1

Table 47 compares the acreage for first year/first choice prescriptions within 99 percent of the currently infested areas in aquatic influence zones for each alternative, including the 67 percent of treatments common to all alternatives described above. This table is shaded to show similarities and differences between first year/first choice treatments within aquatic influence zones under each alternative. During implementation, other effective herbicides may be used in place of the first choice, even during the first year's entry. All treatments would follow MR/MM and comply with herbicide use buffers to minimize potential for impacts to water resources from herbicide use within the aquatic influence zones.

Table 47. First Choice Treatments within the Aquatic Influence Zones by Alternative

"First Choice" Treatment in each Alternatives[1]			Infested Acres to be treated within Aquatic Influence Zones (acres)	Percent of all Currently Infested Acres within Aquatic Influence Zones
Alternative 1	Alternative 2	Alternative 3		
Imazapyr/ glyphosate	Imazapyr/ glyphosate	Imazapyr/ glyphosate	727.2	54%
Glyphosate	Glyphosate	Glyphosate	170.1	13%
Hand-pull	Hand-pull	Hand-pull	8.9	1%
Glyphosate	Broadcast-glyphosate	Broadcast-glyphosate	29.1	2%
Glyphosate	Chlorsulfuron	Chlorsulfuron	5.6	0.4%
Clopyralid	Broadcast-aminopyralid	Broadcast-clopyralid	194.1	14%
Clopyralid	Aminopyralid	Triclopyr/ clopyralid	71.2	5%
Clopyralid	Aminopyralid	Clopyralid	31.6	3%
Biocontrol/ clopyralid	Biocontrol/ broadcast aminopyralid	Biocontrol/ broadcast clopyralid	33.9	2%
Glyphosate/ clopyralid	Broadcast-aminopyralid	Broadcast-metsulfuron methyl	12.5	1%
Glyphosate	Broadcast-aminopyralid	Triclopyr	11.8	1%

"First Choice" Treatment in each Alternatives[1]			Infested Acres to be treated within Aquatic Influence Zones (acres)	Percent of all Currently Infested Acres within Aquatic Influence Zones
Alternative 1	**Alternative 2**	**Alternative 3**		
Clopyralid/ hand-pull	Broadcast aminopyralid/ broadcast clopyralid/ hand-pull	Broadcast clopyralid/ broadcast metsulfuron methyl/ hand-pull	8.2	1%
Clopyralid	Aminopyralid/ chlorsulfuron	Chlorsulfuron/ clopyralid	6.9	1%
Glyphosate/ clopyralid	Broadcast aminopyralid/ broadcast clopyralid/ hand-pull	Broadcast glyphosate/ broadcast clopyralid	6.9	1%
Glyphosate/ clopyralid	Aminopyralid	Metsulfuron methyl	4.8	0.4%
Imazapyr/ glyphosate	Aminopyralid	Imazapyr/glyphosate	4.4	0.3%
Clopyralid	Broadcast-aminopyralid	Broadcast metsulfuron methyl/ clopyralid	3.1	0.2%
Clopyralid	Broadcast-aminopyralid	Broadcast clopyralid	3.1	0.2%

1 Shading denotes which alternatives would approve the proposed treatment: Green = first choice treatment is a currently approved method; orange = first choice treatment is proposed in both Alternatives 2 and 3; yellow = first choice treatment is proposed only in Alternative 2.

3.7.3.3 Early Detection-Rapid Response (EDRR)

Effects of early detection-rapid response treatments would be the same as those analyzed below in Environmental Consequences. In order for a new infestation to be controlled outside of an established Treatment Analysis area, the range of treatment methods must be the same, and each year an Interdisciplinary Team would meet to review all proposed EDRR treatments to determine if site locations and treatments are within the parameters of this project analysis. All EDRR treatments would follow the mitigation measures and management requirements (MR/MM) including:

- Annual limitations on the amount of herbicide treatments within riparian reserves of 6th field sub-watersheds (less than 10% of riparian reserve areas),
- Monthly limitations on the amount of herbicide treatments around a lake or pond (No more than half the perimeter or 50 percent of the vegetative cover or 10 contiguous acres),
- Only allowing herbicide application where groundcover exists (more than 50 percent groundcover on shallow slopes and 70 percent on steep slopes), and
- By apply erosion control measures and native revegetation to areas of gouging or soil displacement resulting from manual treatment methods (digging or pulling) within 35 feet of water courses with surface water present or in areas where soil disturbance or de-vegetation may result in the delivery of measurable levels of fine sediment to federally listed fish species' critical habitat.

These limitations are expected to keep the direct, indirect and cumulative effects to the water resource within the bounds of this analysis.

3.7.3.4 Effects on Water Quality

Water Temperature

Pulling and killing invasive plants can reduce shade which can increase the amount of solar input into streams. Dead vegetation, if not removed, would continue to provide shade. The influence of riparian vegetation on stream shading varies with vegetation height, location, density, and is further affected by stream width, orientation, and slope steepness in the adjacent uplands. Due to their generally short nature, most invasive plants provide little or no shade to streams. Most non- invasive plants identified in this document are less than 4 feet tall and do not contribute measurably to stream shading. Water temperature is most typically driven by terrain slope and tree height in the northern Cascades, thus removal of short, stream-adjacent vegetation is expected to have minimal and indiscernible effect on water temperature.

The treatment of aquatic emergent invasive plants has been identified in similar projects as potentially affecting channel conditions due to the proximity of treatments to the waterways.

The only known aquatic emergent invasive plant currently located on the forest is reed canarygrass, of which there is only one known infestation. This infested area is located in on a reclaimed parcel called the Kaaland Property that was acquired in support of the Skagit Wild & Scenic River Corridor management. Herbicide treatments are expected to merely control this infestation along the stream bank of the Skagit River and would have no effect on water temperature in the Skagit River, since the river measures over 750 feet across the main channel at this location. With a channel that wide, current vegetation is expected to have no solar shading effect on the stream, thus the removal of this vegetation would have no impact on water temperature. In cases where other infestations are found, the project includes mitigation measures and revegetation techniques that would further address any likelihood of effect. Any riparian areas that are found to have a dense monoculture of reed canarygrass would be revegetated with native sedges, grasses, forbs, and shrubs. Any loss of stream shade that occurs from this vegetation removal is expected to be temporary, and the anticipated revegetation techniques that are employed would shorten the length of time when stream-adjacent areas are lacking small, herbaceous cover.

All alternatives would have no effect on streams or water bodies listed for water temperature under section 303(d) of the Clean Water Act since they are all expected to have indiscernible effects to water temperature at the site scale or broader. All alternatives would comply with the Clean Water Act, State water temperature standards, and the Aquatic Conservation Strategy Objectives of the NWFP that relate to water temperature.

Sediment and Turbidity

Sediment delivery to streams is dependent on the erosivity of the soil, slope, distance to a stream, amount of exposed soil (effective ground cover), and intensity and continuity of disturbance. All alternatives treat invasive plants and thus temporarily reduce ground cover, but the extent and continuity of is expected to be small in all alternatives.

The method of treatment influences the potential for impacts on sediment delivery to streams. The proposed treatments other than manual would not cause measurable increases in erosion or turbidity because dead vegetation would be left in place, thus maintaining effective ground cover (i.e., there is no ground disturbance).

The treatment method with the most potential to affect sediment and turbidity is manual treatment, which is included in all alternatives in this project. Manual treatment normally consists of invasive plant pulling, but may include invasive plant wrenching, cutting the root off or breaking them free with a shovel or

Polaski. This treatment can result in some ground disturbance and the potential for increasing erosion and sediment delivery to streams.

Disturbed ground within 35 feet of waterways that have surface water present would be seeded and mulched to reduce erosion and sediment delivery. The combination of these mitigation measures is expected to reduce, but not eliminate, the amount of erosion and sediment delivery that results from manual treatments. Increases in stream turbidity are expected to be highest during post-treatment precipitation events that occur before native and seeded vegetation becomes rooted.

The extent and continuity of manual treatments is expected to be small in this project and isolated to areas where herbicides cannot be used or are ineffective. In most cases, herbicide use is considered a more cost-effective treatment method for control or eradication of many invasive species, thus herbicide use is expected to be used most often. Minimal sediment is expected to be delivered to streams as a result of the small anticipated amount of manual treatments that would occur in close proximity (within 100 feet) to streams in all considered alternatives.

Alternatives 2 and 3 provide further protection than Alternative 1 by requiring that areas of gouging or soil displacement resulting from manual treatment methods (e.g., digging or pulling) within 35 feet of water courses with surface water present be treated to prevent rill and gully erosion and possible sediment delivery to steam courses. Erosion control treatment would include scattering seed and mulch (straw) to create flow disruption and surface soil stability. This measure would help initiate the establishment of native species and further dissipate erosion and reduce the likelihood of sediment delivery to streams.

Turbidity levels generated by manually pulling reed canary grass adjacent to a stream channel would be reduced by dilution and mixing as it moves downstream. Turbidity generated from pulling reed canary grass from lake areas may take even longer to dissipate. Again, erosion control measures would be applied within 35 feet of water bodies with water present to mitigate any potential sediment from reach water bodies.

Treating invasive plants would improve riparian stability where invasive plants such as knotweed plants have colonized along stream channels and out-competed native species. All invasive plant treatments carry some risk that removing invasive plants could exacerbate stream instability; however mulching, competitive seeding and planting would be implemented as needed to revegetate riparian and other treated areas. Disturbed areas within 35 feet of waterways would be re-vegetated with a minimum of seeding and mulch immediately following treatment as described in the mitigation measures of this project to ensure water quality is protected from sediment delivery. Treatments within the aquatic influence zone could result in negligible amounts of sediment due to erosion related to the minor ground disturbance associated with manual, mechanical and to a lesser extent, plant death due to herbicide treatments.

While modification of surface ground cover can also change the timing of run-off, infested areas comprise such a small portion of any watershed that effects to stream flows are implausible.

Water Chemistry

Herbicides used under the existing NEPA decisions could enter water through spray drift, surface water runoff, percolation into groundwater, and windblown transport of herbicide attached to soil particles. The routes for herbicide to contaminate water are; direct application, drift into streams from spraying, runoff from a large rain storm soon after application, and leaching through soil into shallow ground water or into a stream. No direct application of herbicide to water is intended in any alternative. However, runoff from treatments within riparian areas and hydrologically connected ditches is possible.

Drift, including inadvertent overspray, is the most likely vector for herbicides coming in contact with water from riparian area or aquatic emergent vegetation treatment sites. The potential for drift varies with the herbicide application method. Spot and hand/selective application methods substantially reduce the potential for drift. Drift associated with broadcast treatments is minimized by MR/MM 7 which does not allow broadcast spray when wind speed at the site is in excess of 5 mph, and requires use of low nozzle pressure; and use of nozzle diameter to produce a median droplet diameter of 500-800 microns (coarse spray).

Label restrictions; restrictions on application rate, type of herbicide, and application method; buffers; and the use of adjuvants all factor in to limiting the potential amount and effects of drift.

Herbicide can move from the treatment location into adjacent areas through runoff. Some runoff can enter streams either through road or slope drainage. Roadside ditches can act as herbicide delivery routes to streams during high rainfalls or as settling ponds following rainfall events. Roads that have a higher potential for herbicide delivery to fish bearing streams have been identified and have added restrictions, such as no broadcasting of certain herbicides. About 30 percent (1,217 acres) of the current infestations are mapped within 25 feet of these roads. Although there would be no herbicide applied directly to the water column for purposes of treating submerged vegetation, there may be some fine droplets from herbicide applications near streams or along higher risk roads.

Herbicides affect lakes and wetlands differently than streams. Dilution by flow or tributary inflow is generally less effective in lakes. Dilution is partially a function of lake size, but dilution could be rapid in small lakes with large water contributing areas. Decreases in herbicide concentration in lakes, ponds, and other lentic water bodies are largely a function of chemical and biological degradation processes rather than of dilution. Evaporation of water from a lake's surface can concentrate chemical constituents. As vegetation emerging from water dies the oxygen level within a lake or wetland can decrease.

Multiple treatments may occur in 1 year, however this analysis assumes that only a subset of the areas would be treated multiple times in one growing season, that repeat treatments would occur about a month apart, and most of these areas would be treated no more than three times within one growing season.

In some cases, a mix of herbicide ingredients is the most effective treatment for invasive plants. For instance imazapyr mixed with glyphosate is more effective on knotweed plant than either herbicide is alone.

Combinations of chemicals in low doses have rarely demonstrated synergistic effects. Review of the scientific literature on toxicological effects and toxicological interactions indicate that exposure to a mixture of pesticides is more likely to lead to additive rather than synergistic effects (ATSDR 2004.; U.S.EPA/ORD 2000). Synergistic or additive [adverse] effects, if any, are expected to be insignificant (R6 2005 FEIS, pg. 4-3).

Previous Monitoring Results

The United States Geological Service, in partnership with the Oregon Department of Transportation, studied runoff of herbicides along roads (Wood 2001). The study was conducted on runoff associated with sulfometuron methyl and glyphosate along a road in western Oregon. Water (simulated rainfall) was applied at 0.33 inches an hour at 1, 7 and 14 days after treatment. Samples were collected at the shoulder of the road and found concentrations of several hundred ppb of sulfometuron-methyl and nearly 1,000 ppb of glyphosate that could potentially leave the road shoulder. In the fall, the road was again sprayed and the ditch line of the road was checked during natural rainstorms for 3 months. Sulfometuron-methyl was found in concentrations of 0.1 to 1 parts per billion (ppb) along the shoulder and from 0.3 to 0.1 ppb in the ditch line, but below detectable limits in the stream. Glyphosate was not found at the shoulder, ditch line or stream. This study indicates that the greatest risk of herbicides moving off site is from large storms soon after herbicide application. There was about a 1.5 order of magnitude decline from results within 24 hours of application to results from test plots taken the second week after application. In addition, this study also indicates that sulfometuron methyl may persist in the environment as it was detectable along the shoulder of the road (but not in the stream) the entire duration (3 months) of the study. The highest risk of herbicide applications in dry channels and hydrologically connected road ditches is from broadcast spraying covering larger areas.

Berg (2004) compiled monitoring results for broadcast herbicide treatments given various buffers along water bodies. The results showed that any buffer helps lower the concentration of herbicide in streams adjacent to treated areas. In California, when buffers between 25 and 200 feet were used, herbicides were not detected in monitored streams (detection limits of 1to 3 mg/m3) (ibid). Triclopyr was detected following the first runoff event within 90 days of application. This detection was attributed to runoff picking up the chemical in an ephemeral stream reach which was sprayed while it was dry.

In South Carolina, buffers of 30 meters (comparable to 100 feet) during ground applications of the herbicides imazapyr, picloram and triclopyr resulted in no detectable concentrations of herbicide in monitored streams (ibid). No detection limits were given.

Even smaller buffers have successfully protected water quality. For example, where imazapyr was aerial sprayed without a buffer, the stream concentration was 680 mg/ml. With a 15-meter buffer, the concentration was below detectable limits (ibid.). No detection limits were given.

Berg also reported that herbicide applied in or along dry ephemeral or intermittent stream channels may enter streams through run-off if a large rainstorm occurred soon after treatment. This risk is minimized if intermittent and ephemeral channels are buffered (ibid.). Risk may also be minimized by limitations on herbicide selection and application method. If a large rainstorm occurs sediment contaminated by herbicide could be carried into streams. As most ditch lines on the National Forest and Scenic Area are heavily vegetated, this is less likely to occur than in a drier environment.

The Washington State Department of Agriculture (WSDA 2004, 2005 and 2006) monitored residual concentrations of aquatic labeled herbicides for treatment of aquatic emergent invasive plants. Ten out of the sixteen sites sampled between the years 2003 and 2005 showed residual herbicide levels that were below a level of concern for drinking water. The rest showed no detectable level of herbicide.

Additional monitoring studies of herbicide drift and runoff results are summarized here. An 8 month post-treatment study of herbicide spray applications of picloram, triclopyr, and imazapyr, in power line rights-of-way was conducted in eastern New York (Environmental Consultants, Inc. 1991:III-43). Sites were selected with sandy or sandy loam soils to be the most likely to allow herbicide leaching. Buffer widths ranged from 10 to 100 feet. Samples were collected immediately downstream at 6 hour intervals until the streams froze and resumed with the spring thaw. Most of the samples collected did not have detectable levels of herbicide. Of those that did, samples containing detectable levels of imazapyr and picloram were collected shortly after application (indicating drift) or after the first significant rainfall event and one sample in the spring after autumn application. The highest concentrations of herbicide detected were 2 ppb for triclopyr, 1 ppb for picloram, and 6 ppb for imazapyr.

Watershed scale monitoring was completed for 13 herbicides (including glyphosate and triclopyr) in California in the late 1990’s. Samples were taken on the Klamath, Trinity, and Scott Rivers, and Elk, Pine, and Supply Creeks partially in conjunction with runoff events (Jones et al. 2000a). Active ingredients totaling 40,631 pounds of 13 herbicides plus 19 insecticides were applied upstream of the monitoring sites. Samples collected in dry weather in September 1998 served as background. Samples in October of

1998 and 1999 sampled storm runoff and samples collected in June 1999 corresponded to the end of the heaviest pesticide application season. No detectable concentrations of any herbicides were identified (reliable detection limits ranged from 0.04 to 2.0 ppb). The lack of positive detections is probably attributable to chemical degradation, absorption to soil, dilution in stream flow between the application and monitoring sites.

A detailed discussion about herbicide delivery and fate are contained in the herbicide risk assessments completed by The Syracuse Environmental Research Associates, Inc. (SERA).

Studies by Evans and Duseja (1973) and Johnsen and Warskow (1980) showed rapid dilution after herbicide entered the water. Evans and Duseja sprayed picloram at 1 to 2 lbs./ac (2.9 to 5.7 times the typical application rate) on 1 to 2-acre plots. They took samples 5, 10, 100, and 1000 meters (16, 33, 328, and 3,281 feet) below the treated areas in a drainage ditch with no base flow after a 1.5 inch rainstorm occurred within a week of the treatment. Picloram concentrations were diluted by 85 to 98 percent within 100 meters (328 feet) and were diluted to below detection levels at all but one site within 1000 meters (3281 feet). Within 12 weeks all concentrations were at or below 0.001 ppm and within a year it was not detectable. Johnsen and Warskow injected 1.5 pounds of picloram directly into a 1.3 cfs stream in Arizona. The original 6.258 ppm solution was diluted to 96 percent by the time it reached 1600 meters (about a mile) downstream. Two days after the treatment, concentrations were near the point of detection at the 400 and 1600 meter (1312 and 5249 feet) below the treated area. The original concentration was about 560 times the highest application concentration analyzed by the herbicide risk assessment completed by SERA for the R6 2005 FEIS.

Effects from Riparian Treatment (Site Scale)

Best Management Practices (BMPs) would be employed to help assure that water quality is not degraded. Relevant Water Quality BMPs were incorporated into the MR/MM. The objectives of the MR/MM is to keep herbicide residues in surface and ground water below levels that may be harmful, may chemically change to harmful forms, or that may accumulate in sediments or bio-accumulate in aquatic life to levels that adversely affect public health, aquatic life, wildlife, or other designated beneficial uses. Measures to reduce the risk of herbicide entering the hydrologic system include limiting drift, limiting runoff, reducing potential for and effects from accidental spills, applying buffers around water bodies, soils, water quality, fisheries and aquatic organism protection, and using only the lowest effect rate.

In Alternatives 2 and 3, application of herbicides directly on target plant near water’s edge poses a very low risk of delivering of herbicide to adjacent waters. Herbicides with low potential to affect beneficial uses of water may be applied near streams. Herbicide use buffers would prevent herbicide from reaching streams or other water bodies in concentrations over a threshold of concern.

Treatments would not add measurable amounts of organic matter or nutrients to streams or lakes or further degrade water chemistry due to the discontinuity of the treatments, limited spatial scale, and required mitigation measures. Alternatives 2 and 3 both allow for herbicide application on seasonally intermittent streams when they are dry, thus there is a risk of elevated herbicide concentration associated with precipitation runoff events. However, management requirements have been developed to mitigate this small potential primarily by limiting treatments prior to forecast precipitation.

Clopyralid, glyphosate and imazapyr would be proposed for use in aquatic influence zones in all alternatives including No Action. Use of glyphosate would be the first choice for comparatively more acreage in Alternative 1 than Alternative 2 and 3. Aminopyralid would be used in Alternative 2 only. Comparatively less clopyralid and glyphosate would be used as a first choice option within aquatic influence zones. Triclopyr TEA and metsulfuron methyl would be the first choice on a portion of infested acreage within the aquatic influence zone in Alternative 3 only.

The human health and fisheries analyses (see Chapters 3.3 and 3.8) consider the effects of herbicide use based on the unbuffered/unmitigated scenarios for water contamination in the SERA risk assessments. Peak concentration of herbicide in water based on MBS maximum herbicide use rates are shown in Table 48 for the first year/first choice herbicides proposed for use within aquatic influence zones, based on GLEAMS model results in the SERA risk assessments.

The influence of the MR/MM and herbicide use buffers has not be quantified, but would likely reduce the amount of herbicide that may reach streams compared to the upper and central estimates in the SERA risk assessments. The GLEAMS model results in the risk assessments, shown in Table 48, do not differentiate between application method. These results indicate that use of herbicide near streams may result in small amounts of herbicide reaching water, but beneficial uses of water would be maintained. The herbicide use buffers that restrict broadcasting and spot treatment of some of the herbicides within the aquatic influence zone would help reduce the amount of herbicide potentially entering streams.

The MR/MM that limit the potential for herbicides to enter water in the No-Action Alternative include MR/MM 21 and 22 (weather restrictions); and MR/MM 17 and 27 (spill control).

The MR/MM that limit the potential for herbicides to enter water in the action alternatives include MR/MM 7 (weather conditions and nozzle size); MR/MM 8 (herbicide transportation and handling safety); MR/MM 19 (limitations on acreage treated annually within riparian reserves); MR/MM 22 (restrictions on mixing of herbicides near streams); MR/MM 25 (restrictions on use of herbicides on seasonally high water tables); MR/MM 27 that limits herbicide use on sites more prone to run off and MR/MM 29 that references the herbicide use buffers.

Table 48. Central, lower and upper estimates for peak concentration of herbicides in water when used adjacent to streams

Herbicide	Peak Concentration in Water, SERA Risk Assessments, Central Estimate (mg/l or ppm)	Peak Concentration in Water, SERA Risk Assessments, Lower Estimate (mg/l or ppm)	Peak Concentration in Water, SERA Risk Assessments, Upper Estimate (mg/l or ppm)
Metsulfuron methyl	0.00015	0.0000075	0.00075
Clopyralid	0.01	0.0025	0.035
Aminopyralid	0.0009	0.000018	0.0054
Glyphosate	0.044	0.0052	0.332
Triclopyr TEA	0.006	0.000002	0.48
Imazapyr	0.025	0.00001125	0.325

3.7.3.5 Effects from Treatment on Roads with High Risk of Herbicide Delivery to Fish Bearing Streams

Roadside ditches have high run off potential and treatments along roads may deliver herbicide to streams. However, treatments along roads are unlikely to result in concentrations of herbicide reaching streams in amounts likely to harm drinking water (see Chapter 3.3 for more information on human health and drinking water) nor would concentrations be great enough to harm fish or habitat (see Chapter 3.8 for more information on effects on aquatic resources). MR/MM 16, 17 and 18 would minimize the potential for harmful herbicide delivery from roadside treatments. MR/MM 16 prioritizes non-herbicide or lower risk herbicide treatments on roads that are within 200 feet of fish bearing streams. Use of aminopyralid, clopyralid, imazapic, and metsulfuron methyl, aquatic glyphosate, aquatic triclopyr, and aquatic imazapyr would be prioritized over other herbicides and no picloram or non-aquatic triclopyr BEE would be used on roads that have a higher risk of herbicide delivery to fish habitat.

MR/MM 17 ensures that only aquatic glyphosate, aquatic imazapyr, aminopyralid, clopyralid, imazapic, and metsulfuron methyl may be applied with a broadcast method on roads that have a higher risk of herbicide delivery to fish bearing streams. MR/MM 18 ensures that non-aquatic herbicides, chlorsulfuron, picloram or sulfometuron methyl would not be used within 15 feet of any wet roadside ditch.

3.7.3.6 Accidental Spills

Accidental spills are not considered a direct or indirect effect of treatments in any of the alternatives. MR/MM would reduce the potential for spills to occur. An herbicide transportation and handling plan would limit the amount of herbicide transported on the Forest, which would reduce the magnitude of a spill. MM/RR in the project require a spill kit, spill response plan, and immediate action in the case of a spill. The potential for a spill is further reduced around water through MR/MM that limit the amount of herbicide that can be carried near water and require that fueling and mixing be done away from water.

The SERA risk assessments evaluated the amount of herbicide a small child might consume after drinking from a quarter-acre pond shortly after a 200 gallon spill without containment measures being taken. MR/MM 8 includes measures to reduce the potential for a spill and increase the likelihood of containment. MR/MM 8 ensures that workers would carry only enough herbicide daily to cover the proposed treatment for that day, which is likely to less than 200 gallons of herbicide. No reportable spills have occurred on similar projects in Region Six (Desser 2013).

The concentration of herbicide in the water as a result of an accidental spill depends on the rate of application and the streams' ratio of surface area to volume. The persistence of the herbicide in water depends on the length of stream where the accidental spill took place, velocity of stream flow, and hydrologic characteristics of the stream channel. The concentration of herbicides would decrease rapidly down-stream because of dilution and interactions with physical and biological properties of the stream system (Norris et al. 1991).

3.7.3.7 Streams and Lakes on the 303(d) List

This project uses the most current 303(d) list for freshwater in the State of Washington which was published in 2008. MR/MM mitigate potential effects to water quality. This project would have no effect on streams and lakes listed under Section 303(d) of the Clean Water Act.

The following analysis explains why no effects are likely, including to streams listed for water temperature or fine sediment.

1. This project would primarily treat non-emergent vegetation or emergent vegetation in areas where no surface water is present.
2. Treatments of non-emergent vegetation within 100 feet of 303(d) streams would not add measurable amounts of organic matter or nutrients to streams or lakes or further degrade pH, chlorophyll a, or dissolved oxygen (DO) due to the scale of treatments discussed under the alternatives. While there is a very small potential for chemical treatment of emergent vegetation (reed canary grass and yellow flag iris) to affect pH, DO, and chlorophyll a, in adjacent waters with high levels of algae, these conditions have never been documented and are assumed to not exist in the project area
3. The proposed herbicides do not contain dioxins that would further degrade the water chemistry levels in Dorothy Lake.

4. Spot and hand spraying within riparian areas would reduce potential for drift compared to broadcast treatments and.

Table 48 shows results from this analysis for the herbicides that may be used within 100 feet of wet streams. Effects from drift, runoff and leaching were considered in the SERA Risk Assessments assuming broadcast treatment occurred directly adjacent to streams. The Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) model was used to estimate the amount of herbicide that could potentially reach a reference stream via runoff, drift and leaching in a 96 hour period, assuming broadcast treatments on a 50-foot strip along about 1.6 miles of a small perennial stream, 1.8 cfs. The herbicide use buffers (Table 10) consider the toxicity, mobility and label requirements to minimize the risk and impact of herbicide delivery to streams and other water bodies. The moderating effect of the herbicide use buffers was not modeled.

3.7.3.8 Groundwater and Geology

As described in the soils effects section, GLEAMS modeling was done to study the movement of herbicides into the soil column assuming the maximum application rates for the project. GLEAMS modeling showed a relative drop in herbicide concentration as herbicides move down into the soil column with most retaining in the top 12 inches where biologic activity of decomposers are most active. Figure 4 illustrates that most of the herbicides adsorb to soil within the top 20 inches, despite all having moderate to high solubility. Below 40 inches, only trace amounts remain, and depending on the depth to groundwater, these trace amounts have some potential to reach groundwater.

Localized discharge of groundwater can occur above the regional aquifers where lenses of impermeable rock or soil are present. The possible presence of herbicide residues in these waters is very low due to the lack of treatment sites present in the upper elevation recharge areas, the requisite percolation through soil and bedrock capable of adsorbing residues, and a large dilution factor within the flow. The possible influx of herbicide residues into these surface waters is also low due to application buffers around springs and other riparian water sources.

Leaching is associated with areas that experience a wetting front that can transport herbicide residue below ground. Valley bottom and alluvial fan areas that accumulate water from adjoining hill slopes have the highest potential for leaching. Heavy rainfall following spring would have a higher likelihood of transporting contaminants downward since moist antecedent conditions would facilitate percolation. Successive rainfall events that transport contaminants downward are rarer during the main period of treatment, June through September. The risk for downward percolation is highest for herbicides that have a higher residency time and fairly stable in water.

MR/MM for the project would reduce the risk of generating excess herbicide residues capable of being transported vertically through the soil profile. These include restricted application rates of all proposed herbicides to minimize excess residues, restricted application of highly mobile herbicides, restricted timing of application prior to forecasted precipitation, and restricted application within intermittent stream channels. Application of herbicides would also occur during drier times of the year, which reduces movement of herbicide through the soil and allows the targeted plants to uptake the herbicide. Soils adsorb and degrade herbicide residues, which minimizes leaching into groundwater.

3.7.3.9 Water Resource Alternatives Comparison

Alternative 1

Alternative 1 poses relatively low risk to water resources, however some riparian areas would not be effectively treated and thus the quality of riparian habitat may be reduced. However, no adverse effects on beneficial uses of water would occur.

Alternative 2

Alternative 2 poses relatively low risk to water resources. Herbicide use in accordance with the herbicide use buffers shown in Table 10 and the MR/MM would keep herbicide from reaching streams to a minimum, and no adverse effects to beneficial uses are expected. The use of aminopyralid would improve the Forest Service's ability to treat invasive plants near water, which would help restore riparian habitats.

Alternative 3

Alternative 3 poses relatively low risk to water resources. The herbicide use buffers shown in Table 10 would keep herbicide from reaching streams to a minimum, and no adverse effects to beneficial uses are expected. While treatments in some riparian areas may be less effective than Alternative 2, these differences are not significant to water resources.

3.7.3.10 Cumulative Effects of all Alternatives

Introduction

None of the alternatives are likely have substantial impacts on the water resource. Some herbicide may reach water but no beneficial uses of water would be adversely affected; effects would be positive to the extent that riparian habitat is improved. Pesticides are likely to be found at some level in streams and rivers within and adjacent to the MBS. At the current time, beneficial uses of surface waters within the project area are not adversely affected by pesticide use. The baseline for cumulative effects analysis is the current condition.

Cumulative Effects of Herbicide Use

Chapter 3.1.6.2 discusses the other herbicide use conducted by federal, state and county agencies. Treatments are unlikely to occur in close enough proximity to mix and cause concentrations greater than those disclosed in the risk assessments for acute or chronic exposure. Infestations that cross ownership boundaries are often treated cooperatively so multiple areas are unlikely to be treated simultaneously, though it is possible that herbicide use by these agencies could occur simultaneously with herbicide use proposed in the alternatives. The infested areas are small and scattered across the watersheds and treatments by all agencies comprise a small fraction of watershed area. The small percentage of any watershed currently infested and the MR/MM and caps would serve to reduce the potential for herbicides to reach streams from any alternative. Thus even if simultaneous herbicide use occurred within a 6^{th} field watershed, herbicide use on National Forest is unlikely to contribute to cumulative adverse effects. All agencies would obtain Clean Water Act permits for herbicide use that is likely to reach water.

Most of the national forest system lands being analyzed for this EIS are upstream of other sources of herbicides. By the time the water leaves the Forest, the small amount of herbicide that might reach the stream would be diluted. The potential for accumulation downstream would be based on the potential for herbicide from agricultural use to reach the water in a measurable amount to where the forest service proposes treatment and then for there to be a measurable amount from forest service treatments, so the two sources could combine. This is unlikely, because MR/MM minimize the potential for herbicide to accumulate in water.

Mixing and dilution of any trace amount of herbicide that may result from invasive plant treatment would occur quickly, making it highly unlikely that herbicide concentrations would be additive or synergistic with downstream herbicide use. Given the scattered nature of treatments, and dilution over time and space by mixing and addition of inflow downstream, the amount of herbicide that may be delivered to a common point downstream is very small to non-existent. Private lands are mainly downstream of the project area and any herbicide delivered to water from this project would be rapidly diluted, and thus would not contribute to cumulative downstream effects from pesticide use there.

The following two studies discuss cumulative pesticide residues present in surface waters in the United States.

NWQAP Pesticide Study

Since 1991, the National Water Quality Assessment Program (NWQAP) has implemented interdisciplinary assessments in 51 of the Nation's most important river basins and aquifers, referred to as Study Units, and the High Plains Regional Ground Water Study. The USGS published a report: "*Pesticides in the Nation's Streams and Ground Water, 1992–2001*" (Gillom et al. 2006) that presented evaluations of pesticides in streams and ground water based on findings for the first decadal cycle of NAWQA. The study found that undeveloped streams had one or more detectable pesticides or degradates 65 percent of the time. The study stated that presence of pesticide compounds in predominantly undeveloped watersheds[29] may result from past or present uses within the watershed for purposes such as forest management or maintenance of rights-of-way, uses associated with small areas of urban or agricultural land, or atmospheric transport from other areas. None of the herbicides proposed for use in this project were detected in the national samples (however it is acknowledged that glyphosate is widely used but was omitted from the study).

The report discusses the many delivery mechanisms of pesticides to surface and ground water:

> *Pesticides are transported to streams and ground water primarily by runoff and recharge. Nonpoint sources of pesticides originating from areas where they were applied—rather than point sources such as wastewater discharges—are the most widespread causes of pesticide occurrence in streams and ground water (Modified from Majewski and Capel 1995). The atmosphere is often overlooked as a source of pesticides, which return to earth with precipitation and dry deposition and can reach streams and ground water. Streams are particularly vulnerable to pesticide contamination because runoff from agricultural and urban areas flows directly into streams along with both dissolved and particle-associated pesticides. Ground water is most susceptible to contamination in areas where soils and the underlying unsaturated zone are most permeable and drainage practices do not divert recharge to surface waters.*

The study also stated:

> *Pesticide occurrence in streams and ground water does not necessarily cause adverse effects on aquatic ecosystems or humans. The potential for effects can be assessed by comparing measured pesticide concentrations with water-quality benchmarks, which are based on the concentrations at which effects may occur. No streams draining undeveloped land, and only one stream in a watershed with mixed land uses, had an annual mean concentration greater than a human-health benchmark.*

[29] Refers to urban and rural developments; roads and forest management activities may be occuring in these areas.

Clackamas River Pesticide Study

A study about the background levels of pesticides in surface waters was done on the Clackamas River, part of the Willamette River Basin in western Oregon. The Pesticide occurrence and distribution in the lower Clackamas River Basin, Oregon, 2000–2005 (Carpenter, K.D et al. 2008) was done as part of the NWQAP.

The Clackamas study took place from 2000–2005. Within 119 water samples from the Clackamas and its tributaries, 63 pesticide compounds: 33 herbicides, 15 insecticides, 6 fungicides, and 9 pesticides degradates were detected. Fifty-seven pesticides or degradates were detected in the tributaries (mostly during storms), whereas fewer compounds (26) were detected in samples of source water from the lower mainstem Clackamas River, with fewest (15) occurring in drinking water.

The study stated that the two most commonly detected pesticides were the triazine herbicides simazine and atrazine, which occurred in about one-half of samples. It also said that the active ingredients in the "common household herbicides" RoundUp® (glyphosate) and Crossbow® (triclopyr and 2,4-D) also were frequently detected together. These three herbicides often made up most of the total pesticide concentration in tributaries throughout the study area.

The study stated that pesticides were most prevalent in the Clackamas River during storms, and were present in all storm-runoff samples — averaging 10 individual pesticides per sample from these streams. Two tributaries contained 17-18 different pesticides each during a storm in May 2005. These medium-sized streams drain a mix of agricultural land (row crops and nurseries), pastureland, and rural residential areas. Two small streams that drain the highly urban and industrial northwestern part of the lower basin had the greatest pesticide loads. Streams draining predominantly forested basins contained fewer pesticide detections (2-5 pesticides). The study stated that pesticide use on the Mount Hood National Forest, which comprises most of the Federal land in the upper Clackamas River Basin, was a relatively insignificant contribution.

Study Interpretation

These studies support the conclusion that this project, combined with other herbicide use off Forest, would not result in herbicide concentrations to streams over a threshold of concern for people and/or the environment.

Overlap with Projects on the MBS

Appendix F provides information about the projects that have been recently completed, currently being implemented or are ongoing, and foreseeable future projects on the MBS. None of these projects propose additional pesticide use.

The greatest potential for cumulative effects on water resources would be from overlapping activities in TAA 2, 3, 4, 16, 20, 23, 27, 32, 33, 45, and 49. Of these, TAA 3, 20, 23, 27 and 45 have more than 100 acres of invasive plant treatment proposed within riparian reserves that could overlap with recently completed, current, ongoing, or foreseeable future projects. The other TAAs have much lower potential for impacts that could combine with other projects on the MBS because so little of the riparian reserve would be proposed for treatment in all alternatives, or there would not likely be overlap within the TAA that could cause a cumulative impact to water resources.

Vegetation management in TAA 2, 3, 4, and 16, may overlap with invasive plant treatments in riparian reserves. Riparian reserve conditions would be maintained where invasive plant treatment would help restore native plant communities disturbed by the vegetation management. Sediment delivery could occur from these projects; however mitigation would reduce the potential for adverse impacts to water.

Recreation management projects in TAA 23, 27, 33, 45, and 49 are unlikely to adversely affect water resources or combine with invasive plant treatments to cause any cumulative impacts to water. These projects would be managed to maintain water quality.

Road projects (mainly repair and closure) in TAA 20, 23, 32, 33, 45 and 49 would help improve water quality over the long run. The effects of invasive plant management would not combine with the effects of the road projects to cause any adverse cumulative effects. Stream restoration in TAA 32 would also serve to improve watershed condition and invasive plant treatment would contribute to beneficial cumulative effects by helping to restore native plant communities in riparian reserves.

Some sediment may also be delivered to streams, especially from manual treatment methods in all alternatives. The sediment could combine with sediment generated from other projects and reach streams. However, sediment is not likely to accumulate and impact water resources because (1) native vegetation would be retained on all sites and impacts from the project to any stream system would be minimal and short-lived and (2) sediment delivery is mitigated in other Forest Service projects.

Cumulative Effects Summary

None of the alternatives considered for this project would affect water temperature, dissolved oxygen, pH or chlorophyll a, thus cumulative effects on these water quality indicators are not possible. Invasive plant treatment in all alternatives could result in small amounts of herbicide and/or sediment reaching streams. The risk of adverse effects to water resources is low, and the risk of contributing to adverse cumulative effects is low. Invasive plant treatment could overlap with projects being implemented on the MBS. However, the effects of invasive plant treatment are unlikely to combine with effects of other projects and cause an adverse cumulative effect to water resources. The possibility that herbicides used on this project would mix with herbicide used on other lands within the watersheds is low given the low risk of herbicide delivery and rapid dilution of the small amount of herbicide that may reach streams from the project.

3.7.4 Consistency with Regulations, Policies and Plans

This project would comply with the MBS Forest Plan and requirements detailed in Water Quality Standards for the State of Washington, Chapter 173-201A WAC 1997 & 2003, and Forest Chemicals Chapter 222-38 WAC.

3.8 Fish and Aquatic Organisms

3.8.1 Introduction

This chapter summarizes the effects to fish and their habitats. It discusses management and laws related to the effects on fisheries. Fish distribution was determined from WDFW published GIS data and local biologist knowledge, bull trout critical habitat for lakes and streams was provided by USFWS, Chinook salmon critical habitat data provided by NMFS. Occupied Puget Sound steelhead habitat was assumed to be similar to bull trout critical habitat except for Baker River above Lake Shannon and Gold Creek above Keechelus Lake where steelhead are blocked by large dams and known to be absent.

The effects analysis tiers to the R6 2005 FEIS. Effects methodology follows previous fisheries analyses as published in the Gifford Pinchot and Olympic National Forests Invasive Plant Treatment EIS's.

Specific management direction for aquatic habitats can be found in the 1990 MBS Forest Plan; the 1994 Northwest Forest Plan; regulatory requirements associated with Section 7 of the ESA; the Magnuson-

Stevens Fishery Conservation and Management Act (16 U.S.C. 1801 et seq.), as amended by the Sustainable Fisheries Act of 1996, and its implementing regulations (50 CFR Part 600).

3.8.2 Affected Environment

3.8.2.1 Effects of Invasive Plants on Aquatic Ecosystems

Invasive plants found growing adjacent to or within aquatic influence areas can invade, occupy, and dominate riparian areas and indirectly impact aquatic ecosystems and fish habitat. Studies show that species-rich riparian communities that receive an intermediate level of disturbance (fire, flood, herbivory) have more resources available for invading species (Planty-Tabacchi et al. 1996; Stohlgren et al.1999). Riparian habitats, while making up a relatively small area across the Northwest, have significant ecological, cultural, and economic importance (Parks et al. 2005). Target species such as knotweed plant and blackberry can choke streams, become sediment traps and cause stream aggradation. Spawning gravels locked up in the root masses are unavailable for fish, and the stream areas around the root masses have such accelerated flows that gravels aren't retained, resulting in a net loss of fish habitat.

Invasive plants can change stand structure and alter future inputs of wood and leaves that provide the basic foundation of the aquatic ecosystem food webs. Native vegetation growth may change as a result of invasive plant infestation, and the type and quality of litter fall, and quality of organic matter may decline, which can alter or degrade habitat for aquatic organisms. Primary and secondary consumers that form the basic food source for fish and other aquatic organisms may be indirectly affected.

3.8.2.2 Aquatic Species of Conservation Concern

The MBS has many aquatic Species of conservation concern including species noted in the Aquatic Species Listed as Threatened Under The Endangered Species Act (Table 49) and the Regional Forester's Sensitive Species list (December 2012, see Table 51). No fish species on the MBS are currently proposed for listing under the endangered species act or are listed as endangered.

Fish distribution data is from WDFW and local Forest fish biologists. Information related to life history and status of populations at the Evolutionary Significant Unit (ESU) or Distinct Population Segment (DPS) scale can be found in the following sources:

- R6 2005 FEIS Fisheries Biological Assessment (BA), Environmental Baseline
- NMFS and USFWS Federal Register documents (http://www.nwr.noaa.gov/ESA-Salmon-Listings/Salmon-Populations/Index.cfm), (http://www.fws.gov/pacific/bulltrout/),
- Shared Strategy for Puget Sound for Puget Sound Chinook Salmon, and bull trout population in the Puget Sound area (http://www.sharedsalmonstrategy.org/plan)

Federally Listed Fish Species

Puget Sound (PS) Chinook salmon, Puget Sound steelhead and Coastal/Puget Sound bull trout are known to occur on the Mt. Baker –Snoqualmie National Forest and are listed as Threatened under the Federal Endangered Species Act (ESA). Critical habitat has also been designated for PS Chinook salmon and PS bull trout. Table 49 gives the status and watersheds providing habitat for local fish species listed under the ESA. Table 50 provides basic life cycle information on these species.

Table 49. Species listed under the ESA and their critical habitat (if applicable) within the project area

Species	DPS or Critical Habitat	Status/Federal Register Reference	5th Field Watersheds on MBS (Critical Habitat)	Habitat and Life History
Steelhead	Puget Sound	Threatened/ 72 FR 26722 5/11/07	Upper North Fork Nooksack River Middle Fork Nooksack River South Fork Nooksack River Baker River Skagit River/Diobsud Creek Skagit River/Illabot Creek Middle Skagit River/Finney Creek Cascade River Upper Suiattle River Lower Suiattle River Upper Sauk River Lower Sauk River North Fork Stillaguamish River South Fork Stillaguamish River Pilchuck River Sultan River Skykomish River/Wallace River North Fork Skykomish River South Fork Skykomish River Tye River Beckler River Upper Green River Upper White River Carbon River	The most widespread run type of steelhead on Mt. Baker National Forest is the winter (ocean-maturing) steelhead. Winter steelhead are found in nearly all coastal rivers of Washington. Impassable barriers in streams on Mt. Baker-Snoqualmie National Forest limit their distribution. Winter run steelhead typically enter streams for spawning between November and April (Wydoski and Whitney 2003). Fry emerge in April through June and generally spend 1 to 2 years in freshwater, preferring riffle areas in the summer and occupying pools during the rest of the year (ibid).

Species	DPS or Critical Habitat	Status/Federal Register Reference	5th Field Watersheds on MBS (Critical Habitat)	Habitat and Life History
Chinook Salmon	Puget Sound	Threatened/ 64 FR 14308 3/24/99	Upper North Fork Nooksack River Middle Fork Nooksack River Baker River Skagit River/Diobsud Creek Skagit River/Illabot Creek Cascade River Upper Suiattle River Lower Suiattle River Upper Sauk River Lower Sauk River North Fork Stillaguamish River South Fork Stillaguamish River Pilchuck River North Fork Skykomish River Skykomish River/Wallace River South Fork Skykomish River Tye River Beckler River Upper Green River Upper White River Carbon River	Because of the size of Chinook salmon, they prefer spawning habitats that includes deeper water and larger gravels than for most other salmon species. Two life history types – ocean and stream – are recognized in Chinook salmon, based upon the length of time the juvenile fish spend rearing in streams and rivers. Juvenile ocean-type Chinook salmon out-migrate relatively quickly into saltwater following emergence. Some fry enter marine environments almost immediately, but most inhabit the shallow side margins and estuary areas for up to 2 months. It is unlikely that ocean-type Chinook salmon (fall run Chinook) on Mt. Baker-Snoqualmie National Forest would be exposed to disturbance and herbicides from near stream vegetation treatments. Juvenile stream-type Chinook salmon may overwinter in fresh water, typically migrating to the ocean the following spring.
	Puget Sound Critical Habitat	Designated/ 70 FR 52629 09/02/05		
Bull Trout	Coastal Puget-Sound	Threatened/ 64 FR 58910 11/01/99	Upper North Fork Nooksack River Middle Fork Nooksack River South Fork Nooksack River Baker River Skagit River/Diobsud Creek Skagit River/Illabot Creek Middle Skagit River/Finney Creek Cascade River Upper Suiattle River	Bull trout move upstream in summer and early fall to spawn in September and October – or in November at higher elevations (Wydoski and Whitney 2003). Extended incubation periods (4 to 5 months) make eggs and fry particularly susceptible to increases in fine sediments. Fry remain in the streambed for up to 3 weeks before emerging. Fry are typically found in shallow, backwater side channels and eddies in proximity to instream cover. Juveniles are typically found in interstitial spaces in the substrate, and subadults in deeper pools of streams or in the deep water of lakes.

Species	DPS or Critical Habitat	Status/Federal Register Reference	5th Field Watersheds on MBS (Critical Habitat)	Habitat and Life History
	Coastal Puget-Sound Critical Habitat	Designated/ 75 FR 63898 10/18/10	Lower Suiattle River Upper Sauk River Lower Sauk River North Fork Stillaguamish River South Fork Stillaguamish River Pilchuck River Sultan River Skykomish River/Wallace River North Fork Skykomish River South Fork Skykomish River Tye River Beckler River Upper Green River Upper White River Carbon River	

Life Cycle Timing for Federally Listed Fish Species

Table 50. General life cycle timing of federally listed fish species in the project area

Stock	Migration	Spawning	Incubation	Rearing
Puget Sound Chinook salmon	August to September (Ocean type) March to June (Stream type)	September to November	September to February	Saltwater (Ocean type) Year round (Stream type)
Coastal/ Puget Sound bull trout	Mid-June to November	Mid-September through November	Mid-September to June	Year round
Puget Sound steelhead	Late November to April	December to June	December to August	Year round

Designated Critical Habitat for Pacific Salmon

Critical habitat was designated for Puget Sound Chinook salmon on February 16, 2000 (65 FR 7764), but vacated by court order on April 30, 2002. Critical Habitat for this species was proposed on December 14, 2004 (69 FR 74572) and designated on September 2, 2005 (70 FR 52629).

Fifth field watersheds on Mt. Baker-Snoqualmie National Forest with designated Chinook salmon critical habitat are the North Fork Nooksack River, Upper North Fork Nooksack River, Middle Fork Nooksack River, South Fork Nooksack River, Baker River, Skagit River/Diobsud Creek, Skagit River/ Illabot Creek, Middle Skagit River/ Finney Creek, Cascade River, Upper Suiattle River, Lower Suiattle River, Upper Sauk River, Lower Sauk River, North Fork Stillaguamish River, South Fork Stillaguamish River, Skykomish River/Wallace River, Skykomish River Forks, Tye and Beckler Rivers, Upper White River and Carbon River.

NMFS designates critical habitat based on physical and biological features that are essential to the listed species. Essential features of designated critical habitat are: (1) substrate, (2) water quality, (3) water quantity, (4)water temperature, (5) water velocity, (6) cover/shelter, (7) food for juveniles, (8) riparian vegetation, (9) space, and (10) safe passage conditions (50 CFR 226.212). The three freshwater primary constituent elements of critical habitat are:

1. Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development
2. Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks
3. Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival

Designated critical habitat on the Mt. Baker-Snoqualmie National Forest includes the stream channels in each designated reach, and a lateral extent as defined by the ordinary high water line (Sept. 2, 2005; 70 FR 52629). The primary constituent elements essential for conservation of listed ESUs are those sites and habitat components that support one or more fish life stages, including freshwater spawning sites, freshwater rearing sites, and freshwater migration corridors.

Designated Critical Habitat for Coastal Puget Sound Bull Trout

The USFWS proposed critical habitat for the Coastal Puget Sound DPSs on January 14, 2010 (75 FR 2269) and a final ruling was made on October 18, 2010 (75 FR 63898) to designate bull trout critical habitat for the Klamath River, Columbia River, Jarbridge River, Coastal Puget Sound, and Saint Mary-Belly River populations of bull trout in the coterminous United States.

Fifth field watersheds on Mt. Baker-Snoqualmie National Forest with designated critical habitat are the North Fork Nooksack River, Upper North Fork Nooksack River, Middle Fork Nooksack River, South Fork Nooksack River, Baker River, Skagit River/Diobsud Creek, Skagit River/ Illabot Creek, Middle Skagit River/ Finney Creek, Cascade River, Upper Suiattle River, Lower Suiattle River, Upper Sauk River, Lower Sauk River, North Fork Stillaguamish River, South Fork Stillaguamish River, Skykomish River/Wallace River, Skykomish River Forks, Tye and Beckler Rivers, Upper White River and Carbon River.

Critical habitat extends from the bankfull elevation on one side of the stream channel to the bankfull elevation on the opposite side. Adjacent floodplains are not proposed as critical habitat. The lateral extent of proposed lakes and reservoirs is defined by the perimeter of the water body as mapped on standard 1:24,000 scale maps.

The USFWS critical habitat designation identified those physical and biological features of the habitat that are essential to the conservation of the species and that may require special management consideration or protection. These physical and biological features include, but are not limited to: space for individual and population growth, and for normal behavior; food, water, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, or rearing of offspring; and habitats that are protected from disturbance or are representative of the historic geographical and ecological distribution of a species.

All areas listed as critical habitat for bull trout are within the historic geographic range of the species and contain one or more of these physical or biological features essential to the conservation of the species. The USFWS also included a list of known primary constituent elements with the critical habitat description. The primary constituent elements may include, but are not limited to, features such as spawning sites, feeding sites, and water quality or quantity.

The USFWS determined the primary constituent elements for bull trout from studies of their habitat requirements, life-history characteristics, and population biology, as outlined above. These primary constituent elements are:

1. Permanent water having low levels of contaminants such that normal reproduction, growth and survival are not inhibited.
2. Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures at the upper end of this range. Specific temperatures within this range 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.

3. 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.
4. 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. A minimal amount of fine substrate less than 0.63 cm (0.25) in diameter and minimal substrate embeddedness are characteristic of these conditions.
5. A natural hydrograph, including peak, high, low and base flows within historic ranges or, if regulated, a hydrograph that demonstrates the ability to support bull trout populations.
6. Springs, seeps, groundwater sources, and subsurface water connectivity to contribute to water quality and quantity.
7. Migratory corridors with minimal physical, biological, or chemical barriers between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows.
8. An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.
9. Few or no predatory, interbreeding, or competitive non-native species present.

Infested Sites Near Streams with Listed Fish

Mapped infestations within 150 feet of listed critical habitat, for PS Chinook salmon and PS bull trout, or within 150 feet of streams with suspected occupancy by PS steelhead are shown in Table 51.

Table 51. Infested areas within 150 feet of streams with ESA Listed Fish Species

Fifth Field Watershed Name	Stream Name	NRIS Infestation Identification	Listed Fish Species1
Upper North Fork Nooksack River	Glacier and Falls Creek	01-AR-011	PSS , PSC, BT
	North Fork Nooksack River	01-AR-065	PSS, PSC, BT
Baker River	Sulphur Creek	01-LP-028	BT
	Baker River	01-LP-041	BT
Skagit River/ Illabot Creek	Illabot Creek	01-AR-059	BT
Middle Skagit River/ Finney Creek	Skagit River	01-AR-014 01-AR-046	PSC, PSS, BT
Cascade River	Cascade River	01-AR-51	PSC, PSS, BT
Lower Suiattle River	Suiattle River and Buck Creek	060502001055	PSC, PSS, BT
	Straight Creek Circle Creek	060502001054	PSC, PSS, BT
Upper Sauk River	Sauk River/ Owl Creek	02-AR-018 02-LB-005	PSC, PSS, BT
Lower Sauk River	Sauk River	01-AR-041 02-LP-059	PSC, PSS, BT
South Fork Stillaguamish River	Buck Creek	06050200044 06050200051	PSS, BT
	Beaver Creek	02-LP-004	PSS, BT
	South Fork Stillaguamish River	02-AR-004	PSC, PSS, BT

Fifth Field Watershed Name	Stream Name	NRIS Infestation Identification	Listed Fish Species1
Tye and Beckler Rivers	Tye River	06-DL-002	PSC, PSS, BT
	Beckler River	06-KW-12	PSC, PSS, BT
South Fork Skykomish River	South Fork Skykomish River	06050600204 06-KW-005 06-KW-015 06-KW-016 06-SJ-009	PSC, PSS, BT
	Money Creek	06-KW-001 06050600197	PSC, PSS, BT
	Miller River	06050600196	PSC, PSS, BT
	Rapid River	06-SJ-003	PSC, PSS, BT
	Troublesome Creek	06050600125	PSC, PSS, BT
Upper White River	Huckleberry Creek	06050500262	PSC, PSS, BT
	Wrong Creek	06050500330 06050500342	PSC, PSS, BT
	Viola Creek	06050500339	PSC, PSS, BT
	White River	05-KW-028	PSC, PSS, BT
	Greenwater River	05-LP-010 05-LP-087 05-VW-056 05-TF-010 06050500061	PSC, PSS, BT
Kachess River- Yakima River	Gold Creek Keechelus Lake	05-KW-059	BT

[1] PSC = Puget Sound chinook; PSS = Puget Sound steelhead; BT = Coastal/Puget Sound bull trout.

Essential Fish Habitat (Magnuson-Stevens Act)

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance essential fish habitat (EFH) for those species regulated under a Federal fisheries management plan.

Essential Fish Habitat is defined in the Act as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Essential Fish Habitat includes all freshwater streams accessible to anadromous fish (Chinook, coho, and pink salmon), marine waters, and inter-tidal habitats.

The geographic extent of EFH on the Mt. Baker Snoqualmie National Forest is specifically defined as all currently viable waters and most of the habitat historically accessible to Chinook, coho, and pink salmon within the watersheds identified in Table 52. Salmon EFH excludes areas upstream of longstanding naturally impassible barriers (i.e., natural waterfalls in existence for several hundred years). Salmon EFH includes aquatic areas above all artificial barriers.

The EFH regulations at CFR Section 600.920(e)(l)(i) enable Federal agencies to use existing consultation/environmental review procedures to satisfy EFH consultation requirements if they meet the following criteria: (1) The existing process must provide the NOAA Fisheries (National Marine Fisheries Service – NMFS) with timely notification (60-90 days) of actions that may adversely affect EFH; (2)

Notification must include an assessment of impacts of the proposed action as discussed in Section 600.920(g), and (3) NMFS must have made a "finding" pursuant to section (e)(3) that the existing process satisfies the requirements of section 305 (b)(2) of the Magnuson-Stevens Act.

Regional Forester Sensitive Aquatic Species

Table 52 identifies Regional Forester's Sensitive species in the project area. Regional Forester's Sensitive Species are managed to maintain species viability.

Table 52. Regional Forester's Sensitive Species within the MBS

Species	ESU or DPS	5th Field Watersheds on MBS	Habitat and Life History
Coho Salmon	Puget Sound/ Strait of Georgia	North Fork Nooksack River Upper North Fork Nooksack River Middle Fork Nooksack River South Fork Nooksack River Baker River, Skagit River/Diobsud Creek Skagit River/Illabot Creek Middle Skagit River/Finney Creek Cascade River Upper Suiattle River Lower Suiattle River Upper Sauk River Lower Sauk River North Fork Stillaguamish River South Fork Stillaguamish River Skykomish River/Wallace River Skykomish River Forks Tye and Beckler Rivers Upper White River Carbon River	Coho salmon are found in a broader diversity of habitats than any other anadromous salmonid, from small tributaries of coastal streams to inland tributaries of major rivers (Meehan and Bjornn 1991). In the autumn, as water temperatures decrease, juvenile coho move into available side channels, spring-fed ponds and other off-channel sites to avoid winter floods. Streams with more structure (logs/root wads, boulders, undercut banks) support more coho salmon because they provide both food and cover.
Chum Salmon	Puget Sound/ Strait of Georgia	North Fork Nooksack River Upper North Fork Nooksack River Middle Fork Nooksack River South Fork Nooksack River Baker River Skagit River/Diobsud Creek Skagit River/Illabot Creek Middle Skagit River/Finney Creek Cascade River Upper Suiattle River Lower Suiattle River Upper Sauk River Lower Sauk River North Fork Stillaguamish River South Fork Stillaguamish River Skykomish River/Wallace River Skykomish River Forks Tye and Beckler Rivers Upper White River Carbon River	Freshwater migration in the Pacific Northwest is typically short in distance (<50 miles). Chum salmon utilize low gradient (1-2%), sometimes tidally-influenced reaches of streams for spawning, which limits their spawning distribution on Mt. Baker-Snoqualmie National Forest. Most tidally-influenced areas have been disturbed in some form, which has introduced invasive species, such as knotweed plant along the stream banks or gravel bars.

Species	ESU or DPS	5th Field Watersheds on MBS	Habitat and Life History
Sockeye Salmon	Baker Lake Sockeye	Baker River Middle Skagit River/Finney Creek	Many sockeye salmon that return to the Baker Lake watershed are artificially spawned and reared at a hatchery facility. Sockeye salmon that return in excess of hatchery needs are passed to Baker Lake where sockeye salmon spawning occurs in rivers and streams that are tributaries to lakes, but often sockeye salmon spawn along lake shores in areas where ground water percolates through gravel. Generally, sockeye salmon utilize areas along lake shores where the gravel is small enough to be readily dislodged by digging. Sockeye, however, may also utilize lake shore areas with other substrate types and sizes, depending largely on the presence or absence of upwelling.
Coastal Cutthroat Trout	Puget Sound	North Fork Nooksack River Upper North Fork Nooksack River Middle Fork Nooksack River South Fork Nooksack River Baker River Skagit River/Diobsud Creek Skagit River/Illabot Creek Middle Skagit River/Finney Creek Cascade River Upper Suiattle River Lower Suiattle River Upper Sauk River Lower Sauk River North Fork Stillaguamish River South Fork Stillaguamish River Skykomish River/Wallace River Skykomish River Forks Tye and Beckler Rivers North Fork Snoqualmie River Middle Fork Snoqualmie River South Fork Snoqualmie River Upper White River Carbon River	Coastal cutthroat trout exhibit diverse life histories with four distinct life history patterns. The life history patterns include anadromous populations, which migrate to the ocean or estuary for usually less than 1 year before returning to freshwater; fluvial populations that migrate between small spawning tributaries and main rivers downstream; adfluvial populations migrate between spawning tributaries and lakes or reservoirs; and non-migratory resident forms (Quigley and Arbelbide 1997). In Washington, the anadromous cutthroat is typically referred to as "searun" cutthroat and is widely distributed in the lower Columbia River and the Coastal and Puget Sound drainages. Cutthroat trout typically spawn in small streams with juveniles remaining in freshwater. The anadromous juveniles undergo the morphological, physiological and behavioral changes required for migration and adaptation to salt water. In Washington, most coastal cutthroat trout spawn from January up to July, depending on life form. Spawning occurs in riffles where the water depth is about 15 to 45 cm, in areas of low gradient and low flow (WDFW 2000). Newly-emerged fry move quickly to low velocity water at stream margins and backwaters and remain there through the summer to feed. However, in the presence of coho salmon juveniles, which emerge earlier and at a larger size, cutthroat are often driven into higher-velocity waters. Juveniles tend to move to log jams and overhanging banks to shelter during winter. They tend to remain in small streams for about a year then begin to migrate over longer distances within their natal river system.

3.8.3 Environmental Consequences

3.8.3.1 Introduction

Concern has been expressed about the effects of herbicide use on fish and the aquatic ecosystem. Many laws, policies, standards and guidelines relate to aquatic ecosystems and activities near streams. The discussion below focuses on the potential effects on fish and their habitat that may occur with implementation of an alternative. The analysis relies upon and complements findings of the Soil and Water Resources sections. As referred to in the following analysis "fish" include fish species listed under the ESA, fish species designated as sensitive by the Regional Forester, and Management Indicator Species as designated in the MBS Forest Plan. "Fish habitat" includes critical habitat designated under the ESA, Essential Fish Habitat as designated under the Magnuson-Stevens Fishery Conservation Act and all other aquatic habitats occupied by fish.

All alternatives (including No Action) "May Impact" sensitive aquatic species, but none would affect the viability of any species or cause any sensitive species to be listed under the Endangered Species Act. All alternatives would result in long-term restoration where natural plant communities and disturbance regimes have been altered by invasive plants. None of the chemicals proposed for use would result in long-term adverse alteration of aquatic habitat.

The following section discusses effects from non-herbicide and herbicide treatment methods occurring near streams that provide habitat for fish. Several lengthy documents are incorporated by reference including the R6 2005 FEIS and accompanying Fisheries Biological Assessment, Biological Opinions, and SERA Risk Assessments (1997a, 1997b, 1999a, 1999b, 2001a, 2001c, 2003a, 2003b, 2003c, 2003d, 2003e, 2003f, 2011a, 2011b, 2011c, 2011d). The SERA Risk Assessment scenarios were used as indicators of situations where mitigation measures would be necessary to minimize adverse effects on the aquatic ecosystem.

The impacts of invasive plants on the environment can last decades, while the impacts of treatment tend to be short term (weeks or less). Active restoration at selected sites would accelerate native vegetative recovery in treated areas.

3.8.3.2 Effects from Non-Herbicide Treatments

Manual and mechanical treatments can result in increased bank erosion, stream sedimentation, and disturbance to aquatic organisms if carried out over a large, contiguous area in close proximity to occupied stream habitat. Sedimentation can cover eggs or spawning gravels, reduce prey availability, and irritate fish gills.

Sediment generated at the localized scale would be very minor under all alternatives because of the small acreage treated with manual and mechanical methods. These impacts were found to be short term and insignificant (see Appendix J of the R6 2005 FEIS). Effective near stream invasive plant treatment and restoration of treated sites would improve the function of riparian areas and lead to improved fish habitat conditions in the years following passive and active restoration.

Removal of stream shade increases exposure to solar radiation often resulting in elevated water temperatures. There are no known areas on the MBS where invasive plant treatments may decrease riparian vegetative shading, thereby increasing the amount of solar radiation striking the water. Acres of very tall target vegetation along a stream would need to be removed (without any shade-producing vegetation remaining) for water temperature to increase. This situation is unlikely to occur and there are no known invasive plants providing important riparian shade.

3.8.3.3 Herbicides in Aquatic Ecosystems

Herbicide treatments along streams and roadside ditches may result in herbicide reaching water bodies through drift, runoff, and/or leaching. The movement, persistence, and fate of an herbicide in the environment determine the likelihood and the nature of the exposure fish and aquatic habitat may receive. Important determinants of exposure of herbicide to fish are proximity to habitat, herbicide properties, precipitation amount and timing, application rate, extent of application, and application timing.

Herbicides can alter the structure and biological processes of aquatic ecosystems; these effects of herbicides may have more profound influences on communities of fish and other aquatic organisms than direct lethal or sub-lethal toxic effects (Norris et al. 1991). Stream and lake sediments may be contaminated with herbicides by deposition of soils carrying adsorbed herbicides from the land or by adsorption of herbicides from the water. Reductions in cover, shade, and sources of food from riparian vegetation could result from herbicide deposition in a streamside zone (Norris et al. 1991).

Residues in food sources from direct spraying are most likely to occur during and shortly after application. Drift from herbicides considered for use may affect aquatic vegetation at low concentrations, however it shows little tendency to bioaccumulate and is likely to be rapidly excreted by organisms as exposure decreases (Norris et al. 1991).

Herbicide Risks to Fish and Fish Habitat

Most toxicological effects of the proposed action on salmon and steelhead are likely to be from sub-lethal exposure to herbicides, rather than outright mortality from herbicide exposure. Effects such as fish killed as a result of sub lethal changes impairing normal behavioral patterns, otherwise known as ecological death could occur.

Some exposed fish would not respond in any observable or measurable way. It is important to note that many sub-lethal toxicological endpoints or biomarkers may harm fish in ways that are not readily apparent. When small changes in the health or performance of individual fish are observed (e.g. a small percentage change in the activity of a certain enzyme, an increase in oxygen consumption, the formation of pre-neoplastic hepatic lesions, etc.), it may not be possible to infer an impaired normal behavioral pattern, even in circumstances where a significant loss could occur. Where sub-lethal tests have been conducted, they are typically reported for individual test animals under laboratory conditions that lack predators, competitors, certain pathogens, and other hazards found in the natural environment that affect the survival and reproductive potential of individual fish.

The lethal endpoint has little predictive value for assessing whether pesticide exposure may cause sub-lethal neurological and behavioral disorders in wild salmon (Scholz et al. 2000), but in most cases, the LC50 is the only toxicity data available. Although little information is available on the sub-lethal effects of the herbicides on listed fish, there can be subtle sub-lethal effects that can potentially affect the survival or reproduction of large population segments. Recent studies (Fairchild et al. 2008, Fairchild et al. 2009 and Stehr et al. 2009) have shed considerable light on effects of herbicides to early life histories and chronic effects to sensitive trout and salmon found in the Pacific Northwest.

Tierney et al. (2006) studied the effects of five herbicides, including aquatic glyphosate, on coho salmon olfaction (i.e. smell). Coho salmon olfaction ability was reduced within 10 minutes of exposure to 1.0 mg/L of aquatic glyphosate, and more rapidly to higher concentrations. There was no effect to olfaction ability when the aquatic glyphosate concentration was reduced to 0.1 mg/L. No concentrations were tested between 1.0 and 0.1 mg/L, which means that the true NOEC value may have been anywhere between 1.0 and 0.1 mg/L. This NOEC value is based on laboratory studies of pure water and thus may not be applicable to stream situations where soil is present in the water.

The Tierney et al. 2006 paper described the reaction of fish to glyphosate added directly to water in a tank, with no consideration given to the behavior of glyphosate in the environment. Glyphosate binds readily to soil, even in water, so the olfactory effects may not be applicable to actual field conditions.

The ecological significance of sub-lethal toxicological effects on individual fish depends on the degree to which essential behavior patterns are impaired, and the number of individuals exposed to harmful effects. Sub-lethal effects could compromise the viability and genetic integrity of wild populations if the effects are widespread across an entire DPS or ESU, or if localized exposures result in the concentrated impact to fish in a geographic area occupied by a local population with unique genetic traits. The likelihood of population effects from sub-lethal effects of the chemicals in the proposed action are largely undocumented, but appreciable population effects can be ruled out if the potential exposure to harmful effects is limited to small numbers of fish and a spatial pattern that is not likely to cause the loss of a unique genetic stock.

Weis et al. (2001) reviewed published literature on consequences of changes in behavior of fish from exposure to contaminants and noted studies reporting impaired growth and population declines from altered feeding behavior and impaired predator avoidance. Potential sub-lethal effects, such as those leading to a shortened lifespan, reduced reproductive output, or other deleterious biological outcomes are a potential threat to listed species from the considered actions.

The toxicological endpoints identified below are possible for a variety of herbicides and are generally considered to be important for the fitness of salmonids and other fish species. They include:

- Direct mortality at any life history stage
- An increase or decrease in growth
- Changes in reproductive behavior
- A reduction in the number of eggs produced, eggs fertilized, or eggs hatched
- Developmental abnormalities, including behavioral deficits or physical deformities
- Reduced ability to osmoregulate or adapt to salinity gradients
- Reduced ability to tolerate shifts in other environmental variables (e.g. temperature or increased stress)
- An increased susceptibility to disease
- An increased susceptibility to predation
- Changes in migratory behavior

Most of these endpoints have not been investigated for the herbicides used in the proposed action.

The risk of adverse effects on listed salmonids and their habitat was evaluated in terms of hazard quotient (HQ) values. Hazard quotient values are calculated by dividing the expected environmental concentration (expected exposure) by the effects threshold concentration (identified threshold). For fish, the effects threshold was the no-observed-effect concentration (NOEC) used by the R6 2005 Biological Opinion (NMFS 2006). The NOEC is defined as representing the threshold of acute sub-lethal effects. Thus, when the HQ value is greater than 1, then adverse effects on fish, in the form of acute sub-lethal effects, are at a higher risk to occur.

Toxicity Indices for Fish and Habitat

Table 53 shows the toxicity indices for fish. Concentrations of herbicides below this amount would be below a level of concern for fish. The indices represent the most sensitive endpoint from the most sensitive species for which adequate data are available. Where acute NOEC concentrations are not available, 1/20th of published LC50 concentrations (SERA risk assessments) are used. Numbers in bold indicate the toxicity index used in calculating the hazard quotient for exposures to listed fish. Generally, the lowest toxicity index available for the species most sensitive to effects was used. Measured chronic data (NOEC) was used when they were lower than 1/20th of an acute LC50 because they account for at least some sub-lethal effects, and doses that are protective in chronic exposures are more certain to be protective in acute exposures.

Table 53. Toxicity Indices for Fish

Herbicide	Duration	End-point	Concentration	Species	Effect Noted at LOAEL
Aminopyralid	Acute	NOEC	50 mg/L	Rainbow trout	Partial loss of equilibrium at 100 mg/L[1]
	Chronic	NOEC	1.36 mg/L	Fathead minnow	Reductions in fry weight, length, larval survival, and % normal larvae at 2.44 mg/L
Chlorsulfuron	Acute	NOEC	2 mg/L (1/20th of LC50)	Brown trout	LC50 at 40 mg/L
	Chronic	NOEC[2]	3.2 mg/L	Brown trout	rainbow trout length affected at 66mg/L
Clopyralid	Acute	NOEC	5 mg/L (1/20th of LC50)	Rainbow trout	LC50 at 103 mg/L
	Chronic	NOEC	10 mg/L	Daphnia	Estimated from Daphnia NOEC
Glyphosate (no surfactant)	Acute	NOEC	0.1 mg/L[3]	Coho salmon	Olfactory impairment
	Chronic	NOEC	2.57 mg/L[4]	Rainbow trout	Life-cycle study in minnows; LOAEL not given
Imazapic	Acute	NOEC	100 mg/L	All fish	at 100 mg/L, no statistically sig. mortality
	Chronic	NOEC	100 mg/L	Fathead minnow	No treatment related effects to hatch or growth
Imazapyr	Acute	NOEC	5 mg/L (1/20th LC50)	Trout, catfish, bluegill	LC50 at 110-180 mg/L for North American species
	Chronic	NOEC	43.1 mg/L	Rainbow	“nearly significant” effects on early life stages at 92.4 mg/L
Metsulfuron methyl	Acute	NOEC	10 mg/L	Rainbow	lethargy, erratic swimming at 100 mg/L
	Chronic	NOEC	4.5 mg/L	Rainbow	standard length effects at 8 mg/L
Picloram	Acute	NOEC	0.04 mg/L (1/20th LC50)	Cutthroat trout	LC50 at 0.80 mg/L
	Chronic	NOEC	0.55 mg/L	Rainbow trout	body weight and length of fry reduced at 0.88 mg/L
Sulfometuron methyl	Acute	NOEC	7.3 mg/L	Fathead minnow	No signs of toxicity at highest doses tested
	Chronic	NOEC	1.17 mg/L	Fathead minnow	No effects on hatch, survival or growth at highest doses tested
Triclopyr (TEA)	Acute	NOEC	0.26 mg/L (1/20th LC50)	Chum salmon	LC50 at 5.3 mg/L[5]
	Chronic	NOEC	104 mg/L	Fathead minnow	Reduced survival of embryo/larval stages at 140 mg/L

[1] Partial loss of equilibrium was not statistically significant, did not occur in exposures less than 96 hours, and did not occur in another study. EPA set the NOEC at 100 mg/L for rainbow trout.

[2] Chronic value for brown trout (sensitive sp.) was estimated using relative potency in acute and chronic values for rainbow trout, and the acute value for brown trout.

[3] Using values that impaired olfactory function in coho salmon from Tierney et al. 2006.

[4] Estimated from minnow chronic NOEC using the relative potency factor method (SERA Glyphosate 2011).

[5] Using Wan et al. (1989) value for lethal dose.

In addition to effects of direct exposure on listed fish, indirect effects of reduced food sources through the effects herbicides on aquatic non-target species, primarily in the form of reduced algae production and reduced aquatic macrophyte production can occur. The likelihood of adverse indirect effects is dependent on environmental concentrations, bioavailability of the chemical, and persistence of the herbicide in aquatic habitat. For most pesticides, including the chemicals in the proposed action, there is limited information available on environmental effects such as negative impacts on primary production, nutrient dynamics, or the trophic structure of macroinvertebrate communities.

Most available information on potential environmental effects must be inferred from laboratory assays conducted on a specific target endpoint; although a few observations of environmental effects are reported in the literature. Due to the paucity of information, there are uncertainties associated with the following factors: 1) The fate of herbicides in natural streams; 2) the specific effects on, and resiliency and recovery of aquatic communities; 3) the site-specific foraging habits of salmonids and the vulnerability of key prey taxa and 4) the mitigating or exacerbating effects of local environmental conditions.

Benthic algae (Table 54) are important primary producers in aquatic habitats and are thought to be the principal source of energy in many mid-sized streams (Vannote et al. 1980; Murphy 1998). Herbicides cause shifts in the composition of benthic algal communities at concentrations as low as in the low parts per billion. Herbicides can elicit significant effects on aquatic microorganisms at concentrations that may occur with normal usage under the label instructions (De Lorenzo et al. 2001). In most cases the sensitivities of algal species to herbicide formulations and their response to herbicide formulations are not known. However, human activities that modify the physical or chemical characteristics of streams can change the trophic system that ultimately reduces salmonid productivity (Bisson and Bilby 1998). Consequently, herbicides have the potential to affect salmonid productivity through their effects on the biotic community.

Table 54. Toxic Indices for Algae

Herbicide	Duration	Concentration	Species	Effects noted at LOAEL
Aminopyralid	Acute	6 mg/L	Diatoms	Cell density
	Chronic			
Chlorsulfuron	Acute	0.01 mg/L	*Selanastrum capriconutum*	Mortality
	Chronic			
Clopyralid	Acute	6.9 mg/L	*Selanastrum capriconutum*	Growth inhibition
	Chronic	Chronic study of duckweed showed EC50 >> sensitive algae (acute)		
Glyphosate (most toxic formulation)	Glyphosate appears to be about equally toxic to algae and aquatic plants; see aquatic plants table			
Imazapic	Acute	0.05 mg/L ***	Various species	Growth inhibition
	Chronic			
Imazapyr	Acute	0.2 mg/L *	Chlorella	Growth inhibition
	Chronic			
Metsulfuron methyl	Acute	0.09 mg/L	*Selanastrum capriconutum*	Growth inhibition
	Chronic			Only short-term data available
Picloram	Acute	0.23 mg/L	Diatoms	Growth inhibition
	Chronic	0.23 mg/L		

Herbicide	Duration	Concentration	Species	Effects noted at LOAEL
Sulfometuron methyl	Acute	0.0025 mg/L	*Selanastrum capriconutum*	Cell density
	Chronic			
Triclopyr TEA	All exposures	5.9 mg/L *	Unspecified algae	Mortality

* NOEC is estimated from LC50.
** NOEC is estimated from EC10.
*** NOEC estimated from LOEC.

Indirect effects of chemicals used to treat invasive plants on ecosystem structure and function are a key factor in determining a toxicant's complete risk to aquatic organisms (Preston 2002). Aquatic plants (Table 55) are generally more sensitive than fish to acute toxic effects of herbicides. Therefore, chemicals can potentially affect the structure of aquatic communities, at the primary production level, at concentrations below thresholds for direct impairment in fish.

Indirect effects resulting from the proposed action are expected to be of varying duration (days to weeks). Degraded water quality, reflected by primary and secondary productivity loss, may occur for a very short time (hours). Recovery of algae and aquatic macrophytes, if impacts occur, could take up to several weeks.

Table 55. Toxicity Indices for Aquatic Plants (Macrophytes)

Herbicide	Duration	Concentration	Species	Effects noted at LOAEL
Aminopyralid	Acute	44mg/L	Duckweed	Frond Density
	Chronic			
Chlorsulfuron	Acute	0.00047 mg/L *	*Lemna minor*	Mortality
	Chronic			
Clopyralid	See information for algae			
Glyphosate (most toxic formulation)	Acute	3 mg/L	Duckweed	Growth inhibition
	Chronic			
Imazapic	Acute	0.0013 mg/L	*Lemna gibba*	Growth inhibition
	Chronic			
Imazapyr	Acute	0.013 mg/L **	*Lemna gibba*	Growth inhibition
	Chronic			
Metsulfuron methyl	Acute	0.00016 mg/L	Duckweed	Based on chronic data
	Chronic			Mortality
Picloram	Acute	0.1 mg/L ***	Water milfoil	Transient inhibition of flowering
	Chronic			
Sulfometuron methyl	All exposures	0.00021 mg/L	*Lemna gibba*	Mortality
Triclopyr TEA	All exposures	5.9 mg/L *	Unspecified algae	Mortality

* NOEC is estimated from EC50
** NOEC is estimated from EC25
*** NOEC is estimated from LOEC

Juvenile salmonids feed on a diverse array of aquatic invertebrates, with aquatic insects, and crustaceans comprising the large majority of the diets of fry and parr in all salmon species (Levings et al. 1995).

Prominent taxonomic groups in the diet include Chironomidae (midges), Ephemeroptera (mayflies), Plecoptera (stoneflies), Tricoptera (caddisflies), and Simuliidae (blackfly larvae) as well as amphipods, harpacticoid copepods, and daphniids. Chironomids in particular are an important component of the diet of nearly all freshwater salmon fry (Levings et al. 1995). With a few exceptions (e.g. daphniids), the impacts of pesticides on salmonid prey taxa have not been widely investigated. Available studies suggest that aquatic invertebrates (Table 56) are relatively resistant to lethal effects of herbicides however sub-lethal effects may affect invertebrate populations at the site scale.

Availability of food is essential to rearing and migrating fish and is an essential element of those PCEs of critical habitat. The decrease in primary productivity of streams and rivers resulting from herbicide applications would vary in space and in time. Detrimental effects on primary production could be linked to decreases in aquatic invertebrates.

Factors affecting prey species are likely to affect the growth of salmonids, which is largely determined by the availability of prey in freshwater systems. Food supplementation studies (Mason 1976) have shown a clear relationship between food abundance and the growth rate and biomass yield of juveniles in streams. Therefore, herbicide applications that reduce the abundance of aquatic plants (macrophytes) and macroinvertebrates in streams can also reduce the energetic efficiency for growth in salmonids. These considerations are important because juvenile growth is a critical determinant of survival (Baldwin et al. 2009). A study on size-selective mortality in Chinook salmon from the Snake River (Zabel and Williams 2002) found that naturally reared wild fish did not return to spawn if they were below a certain size threshold when they migrated to the ocean. There are two primary reasons mortality is higher among smaller salmonids. First, fish that have a slower rate of growth suffer size-selective predation during their first year in the marine environment (Healey 1982; Beamish and Mahnken 2001). Growth-related mortality occurs late in the first marine year and may determine, in part, the strength of the year class (Beamish and Mahnken 2001). Second, salmon that grow more slowly may be more vulnerable to starvation or exhaustion (Sogard 1997).

Table 56. Toxicity Indices for Aquatic Invertebrates

Herbicide	Duration	Concentration	Species	Effects noted at LOAEL
Aminopyralid	Acute Chronic	98mg/L 102 mg/L	Daphnia magna	No effects observed
Chlorsulfuron	Acute Chronic	10 mg/L 20 mg/L	Daphnid	Mortality
Clopyralid	Acute Chronic	214 mg/L 11.8 mg/L	Daphnid	Mortality
Glyphosate (most toxic formulation)	Acute Chronic	11 mg/L 0.7 mg/L	Daphnia magna	Mortality Estimated from less toxic formulation
Imazapic	Acute Chronic	100 mg/L 100 mg/L	Daphnia magna	No effect at any concentration
Imazapyr	Acute Chronic	100 mg/L 97.1 mg/L	Daphnia magna	No effects observed
Metsulfuron methyl	Acute Chronic	420 mg/L 17 mg/L	Daphnia magna	Immobility Growth
Picloram	Acute	26.8 mg/L	Shrimp	Mortality

Herbicide	Duration	Concentration	Species	Effects noted at LOAEL
	Chronic	3.8 mg/L	Oyster larvae	
Sulfometuron methyl	Acute	75 mg/L	*Alonella* spp. & *Cypria* spp.	Not given
	Chronic	0.19 mg/L		Neonate survival
Triclopyr TEA	Acute	133 mg/L	Not given	Mortality
	Chronic	81 mg/L	Daphnid	Reproduction

NOEC is estimated from LC50.

** NOEC is estimated from LOEC (lowest observable effect concentration.

*** estimated from subchronic study.

Inert Ingredients-Adjuvants, Impurities and Surfactants

Inert ingredients, including adjuvants, impurities and surfactants, were studied as a part of SERA risk assessment for most herbicides. POEA surfactant may be toxic to aquatic species. The 2011 SERA Risk Assessment for glyphosate considered the differences in toxicity to the aquatic ecosystem of glyphosate with and without this surfactant. Other surfactants did not influence the risk assessment findings. The MR/MM in the alternatives have been modified to eliminate use of POEA. This would eliminate potential risks associated with POEA.

Herbicide Application to Ditches and Intermittent Channels

Herbicides applied within ditches and intermittent stream channels may be delivered to places where fish or their food might be exposed by leaching into soil, dissolving directly into ditch or stream channel flow (when present), and erosion of exposed soil. Important 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 aquatic habitat.

The MR/MM and herbicide use buffers limit the amount of any herbicide that may enter the ditch; however an unexpected rainstorm immediately after application may result in a minor amount being delivered downstream. Fish may be exposed at the delivery point for a short amount of time before herbicides are diluted to undetectable levels.

Relative Risk to Fish and Habitat from Herbicides

Every risk assessment models the amount of chemical that can reach water under several different scenarios, then compares model results to existing monitoring data to check the accuracy of the model. Effects from drift, runoff and leaching were considered in the SERA (2001, 2003, 2004, 2011) herbicide risk assessments, prepared for the R6 2005 FEIS (USDA 2005a), assuming broadcast treatments occurring directly adjacent to streams. The GLEAMS model used to estimate the amount of herbicide that may potentially reach a reference stream via runoff, drift and leaching in a 96 hour period, assuming broadcast treatments on a sparsely vegetated 50-foot strip along about 1.6 miles of a 1.8 cfs perennial stream.

Dissipation, degradation and other environmental processes are considered to predict chronic exposure for aquatic species (SERA Worksheet F09 and Tables 3-1 and 3-2, all risk assessments). Calculations are detailed in worksheets, which can be duplicated using site-specific information to predict potential concentrations of chemicals in surface water. This information can then be used to evaluate the potential effects to aquatic organisms and water quality. The effect of MR/MM and herbicide use buffers in reducing predicted HQ values under SERA risk assessment scenarios have not been quantified. SERA worksheets are available to refine some site-specific parameters (such as application rate); however the effect of the mitigation measures in restricting the timing, extent, location, herbicide selection, and application rate cannot be precisely modeled. Table 57 displays which herbicides may exceed HQ of 1 under the SERA modeled acute exposure scenario assuming herbicide treatment of 10 acres adjacent to a small stream. Table 48 in Chapter 3.7 shows the central, upper and lower estimates of concentrations of herbicides predicted to reach streams for herbicides that may be applied within 100 feet of a wet stream.

Table 57. Relative Risk to Fish, Aquatic Invertebrates, Algae and Aquatic Plants From Riparian Use of Herbicides at MBS Rates

	Aminopyralid	Chlorsulfuron	Clopyralid	Glyphosate no surfactant	Glyphosate with POEA surfactant[4]	Imazapic	Imazapyr	Metsulfuron methyl	Picloram	Sulfometuron methyl	Triclopyr TEA
Fish	--	--	--	Ù[1]	Ù[2]	--	--	--	Ù[2]	--	Ù[1]
Aquatic invertebrates	--	--	--	--	--	--	--	--	--	--	--
Algae	--	Ù[1]	--	--	--	--	Ù[1]	--	--	Ù[1]	Ù[1]
Aquatic plants	--	Ù[3]	--	--	--	Ù[1]	Ù[2]	Ù[1]	Ù[1]	Ù[2]	Ù[1]

-- Predicted concentrations are less than the estimated or measured 'no observable effect concentration'.

Ù Predicted concentrations greater than the estimated or measured 'no observable effect concentration' at MBS proposed application rates without mitigation.

[1] At the MBS application rate, the toxicity index is exceeded only in the upper exposure assumptions.
[2] At the MBS application rate, the toxicity index is exceeded in the central and upper exposure assumptions.
[3] Lower, central and upper exposure estimates exceed the toxicity index at the MBS application rates.
[4] POEA surfactant would not be used in this project

Actual proposed treatments contain untreated buffers; or distances within which only spot spray or hand application is allowed. The herbicide use buffers in the alternatives would substantially limit the amount of herbicide potentially coming in contact with water. The potential amount of herbicide coming in contact with water after application of herbicide use buffers would be minimized to almost non-detectable levels. Table 40 in Chapter 3.6 (Soils) shows that most of the herbicide that is applied is taken up by the target plant or remains in the upper 12 inches of the soil profile.

Photo-degradation, hydrolysis, adsorption to particles in the water column and along the channel side and bottom, dilution resulting from influx of additional water (either subsurface or surface), and accretion of volume would together minimize potential effects on fish and aquatic habitats. Herbicides coming in contact with water, if any, would either be well below levels of concern or non-detectable under the proposed alternatives.

Accidental Spills

Accidental spills have the potential to introduce larger amounts of herbicide into streams and other water bodies. Risks are minimized by only carrying the amount of herbicide that would be applied in 1 day and performing all mixing operations well away from any water bodies. The Forest Service has not had a significant or reportable skill in R6 since the implementation of the R6 2005 ROD (Desser 2013).

3.8.3.4 Direct, Indirect and Cumulative Effects by Alternative

The alternatives vary as to the degree of risk to aquatic organisms from herbicide and non-herbicide treatments. All alternatives implement mitigation measures to minimize or avoid adverse effects. None of the alternatives are expected to result in measureable adverse impacts to fish or their habitat.

Alternative 1 (No Action)

The No-Action Alternative would continue the currently approved use of herbicides on the MBS. Aquatic labeled glyphosate, aquatic-labeled imazapyr and clopyralid may be applied within a set of mitigation measures designed to limit the exposure to aquatic habitats and fish.

The greatest risk to the aquatic environment is the potential for a spill of the undiluted concentrate of the aquatic formulation of glyphosate directly into a stream or wetland. To alleviate this risk: herbicide spray mixtures would not be prepared within 300 feet of riparian areas, wetlands, or surface water, and containment mats must be used during mixing to further avoid the risk of a spill.

The aquatic formulation of glyphosate (with Agri-Dex® added, where a surfactant would be needed) was specifically chosen as the herbicide for use on the MBS, not because of its effectiveness per se, but rather because of the lack of effects on the aquatic environment. Washington State Department of Ecology has approved use of glyphosate for use in aquatic environments for treating aquatic invasive plants (Washington State DOE 2001). However, SERA modeling shows that the project has potential to exceed the rate that has shown sub-lethal effects to fish under laboratory conditions. Under the No-Action Alternative, the application methods (no broadcast spraying), plus the limited amount of herbicide that would be used in primarily small infestations and with the prescribed mitigation measures, the risk that the aquatic formulation of glyphosate would reach a measurable level in the aquatic environment is essentially alleviated.

After an extensive literature review, in which the three commonly used surfactants were evaluated for potential use (LI-700®, R-11®, and Agri-dex®), Agri-Dex® was determined to be the least toxic surfactant (SERA 1997). Given the low toxicity of the chemical to fish and the low probability of the chemical reaching fish-bearing water, no effects on fish would be expected from the described treatment methods using this surfactant.

The use of tested and approved, host-specific biological control agents would not be expected to have any effects on fish.

Direct and Indirect Effects to Fish Habitat Including Designated Critical Habitat and Essential Fish Habitat

Of the herbicides evaluated for this alternative, imazapyr was modeled in the SERA worksheets to have the potential to adversely affect algae and aquatic plants at the MBS application rate. If a spill or unexpected rainstorm were to wash imazapyr directly into fish habitat there is some potential that algae or aquatic plants could be affected with isolated reductions of primary productivity occurring. The isolated cases of reduction of the freshwater rearing forage also are not likely to decrease the conservation value of critical habitat, nor detrimentally affect the productivity of the freshwater life cycle.

Physical changes to fish habitat are not likely to occur under Alternative 1 because the type of treatments currently approved are unlikely to result in meaningful erosion or habitat disturbance.

Direct and Indirect Effects to ESA listed, Sensitive and Management Indicator Fish

Of the herbicides evaluated for this alternative, glyphosate was modeled in the SERA worksheets to have the potential to exceed the no effect concentration level for fish at the MBS application rate. In some circumstances, herbicides may wash into streams from rainfall occurring during or shortly after herbicides are applied along road ditches or on low permeability soils. Rainstorms are likely to occur within the watersheds containing listed salmonids. In such instances, adverse effects on fish could occur particularly in small tributary streams where the flows would be diluted more slowly. On certain occasions when rainfalls occur during or soon after herbicide application, fish could be exposed to glyphosate concentrations leading to the occurrence of sub-lethal effects. Outright mortality of fish from herbicide exposure is highly unlikely. While it is possible that individuals would express impaired normal behavioral patterns these outcomes would be limited because exposures would be too intermittent, based on the expected action and its incorporated mitigation measures. As a result, these outcomes are not likely to produce an observable change in the abundance, distribution, diversity, or productivity of fish species at either the population or species level.

Minor disturbance to a small number of individual fish is possible due to human presence from treatments within aquatic influence zones. The effect of this disturbance is expected to be short lived and not have any measureable effect on individuals or populations.

New Invader Strategy (Early Detection and Rapid Response)

The effects to the aquatic environment from treating unknown future populations would be similar to the effects of treating the known inventory. MR/MM and an annual screening process ensure that effects are within the scope of the analysis of known sites.

Alternative 2 (Proposed Action)

Alternative 2 has the greatest potential to benefit aquatic resources by effectively treating invasive plants. MR/MM would minimize the potential for adverse effects on fish and habitat.

Direct and Indirect Effects To Fish Habitat Including Designated Critical Habitat and Essential Fish Habitat

Of the herbicides evaluated for this alternative, several were modeled in the SERA worksheets to have the potential to adversely affect algae and aquatic plants at the MBS application rate. These herbicides include chlorsulfuron, imazapic, imazapyr, metsulfuron methyl and triclopyr. Mitigation measures allow only aquatic labeled versions of imazapyr and triclopyr to be applied to the waterline of aquatic systems; all others are to be used above the bankfull elevation only. Broadcast applications (with the exception of aminopyralid, which poses little risk to fish) require at least a 60 to 100 foot herbicide use buffer. No broadcast spraying of triclopyr is approved.

Localized effects to algae and aquatic plants are possible as a result of treatments that occur within the bankfull channel. These localized effects would not disrupt aquatic ecosystem function of the aquatic food web because of the low potential to reach toxicity levels for each trophic level under spot and hand/select applications with aquatic labeled imazapyr or triclopyr. Some aquatic plants could be damaged at the immediate spot spray locations if enough herbicide comes in contact with the aquatic plant. Not be enough herbicide would contact water to result in aquatic plant mortality.

The amount of herbicide that would be available for runoff, leaching and/or drift is necessarily limited by restrictions on broadcast use. Spot and hand/select treatments have lower potential to deliver herbicide because the treatments are directed at target vegetation and herbicide would not be applied to large contiguous areas.

Physical changes to fish habitat are not likely to occur under Alternative 2 because the type of treatments currently approved are unlikely to result in meaningful erosion or habitat disturbance.

Direct and Indirect Effects to ESA Listed, Sensitive and Management Indicator Fish

Of the herbicides evaluated for this alternative, glyphosate, picloram, and triclopyr were modeled in the SERA worksheets to have the potential to exceed the no effect concentration level for fish at the MBS application rates. Herbicide use buffers have been established based on the persistence, mobility and toxicity of each herbicide and whether or not it has been labeled for aquatic use. The probability that fish would be exposed to harmful concentrations of herbicide is very low due to MR/MM and herbicide use buffers.

In some circumstances, herbicides are likely to wash into streams from rainfall occurring during or shortly after herbicides are applied along road ditches or on low permeability soils. Rainstorms are likely to occur within the watersheds containing listed salmonids. In such instances, adverse effects on fish could occur particularly in small tributary streams where the flows would be diluted more slowly. On certain occasions when rainfalls occur during or soon after herbicide application, listed fish are likely to be exposed to herbicide concentrations leading to the occurrence of sub-lethal effects. Outright mortality of fish from herbicide exposure as a result of the proposed action is highly unlikely. In some circumstances, isolated reductions of primary productivity could occur. While it is possible that individuals will express impaired normal behavioral patterns, these outcomes would be limited because exposures would be intermittent, based on the proposed action and incorporated MR/MM. As a result, herbicide use under this alternative is not likely to produce an observable change in the abundance, distribution, diversity, or productivity of fish species at either the population or species level.

Aquatic organisms may be briefly exposed to measurable levels of glyphosate or other herbicide compounds if an unexpected rainfall event occurs shortly after an application. To be exposed, individuals would need to be near the confluence where a ditch or intermittent stream channel is located when the "first flush" event occurred.

In general, juvenile and adult fish would avoid the presence of human beings and would more than likely swim away from predator like shadows overcasting water bodies. The possibility of a fish being present in the immediate water column where spot spray applications may be taking place up to the water's edge is low. However, fry avoid faster flows and tend to rear along the shoreline or around large substrate/wood where flow is slower. Fry tend to avoid overcasting shadows as well but can return to their previous location after being disturbed if a human stands still enough near the stream margin.

Fish in the mainstem of rivers and streams would have substantially less risk of exposure because of a river's large flow and the relatively low proportion of fish that occur immediately along a river's edge. Smaller streams however, do not have as much flow and may not dilute herbicides as quickly. Fish in smaller streams tend to be juveniles and fry. Although there would be no herbicide applied directly to the water column for purposes of treating submerged vegetation, there may be some fine droplets from spot applications coming in contact with water as a result of treating near shore vegetation.

Early Detection and Rapid Response

The effects to the aquatic environment from treating unknown future populations would be similar to the effects of treating the known inventory. MR/MM, herbicide use buffers, and project caps would ensure that effects are within the scope of the analysis of known sites.

Alternative 3 (No Aminopyralid)

Alternative 3 would have similar effects to aquatic habitat and fish as Alternative 2 except herbicides posing greater relative risk to fish would be the first year/first choice on 10.5 percent more acreage of known infestations within the aquatic influence zone. With proper application of MR/MM, herbicide use buffers and project caps, herbicide use in Alternative 3 would pose a low risk to aquatic habitats and fish.

3.8.3.5 Cumulative Effects for All Alternatives

While some commonly used herbicides are associated with hazards to aquatic organisms, harmful amounts of herbicides coming in contact with water as a result of Forest Service applications are not likely to occur for all existing inventory sites and for future treatments within the scope of this project.

The annual limitation on extent of treatment for within 6th field watersheds further reduces the potential for effects at a meaningful scale. Herbicides coming in contact with water via drift or runoff at the immediate application site would dissipate rapidly and become non-detectable or below levels of concern.

Cities, counties, and Washington state all have ongoing invasive plant treatment programs operating in the region that can affect conditions in the action area (see Chapter 3.1.6). These programs are assumed to have effective aquatic protection measures. Invasive plants are treated along road rights-of-way annually by city, state, and county transportation departments, sometimes several times a year. Any herbicide contamination that occurs from the proposed project could potentially combine with contaminants from other non-Federal activities, and contribute to formation of chemical mixtures or concentrations that could kill or harm listed steelhead or salmon. In addition, fish stressed by elevated sediment and temperatures and limited habitat due to lack of accessibility are more likely to be susceptible to toxic effects of herbicides.

The Management Requirements and Mitigation Measures, along with the herbicide use buffers, reduce the potential for herbicide to reach a level of concern at any scale. There would be no potential for herbicide to accumulate with use downstream and reach a threshold of concern. This is because the amount of treatment proposed compared to the size of the watershed and extent of the aquatic ecosystem is very low and effects to habitat are likely to be negligible. State monitoring data for treatment of aquatic emergent vegetation has either resulted in no detections or below State drinking water standards, which are more restrictive than the levels of concern for fish used for this analysis. See Chapter 3.7 for citations and information about this monitoring.

Activities within riparian reserves in TAA 2, 3, 4, 16, 20, 23, 27, 32, 33, 45, and 49 (especially TAA 3, 20, 23, 27 and 45 that have more than 100 acres of invasive plant treatment proposed within riparian reserves) have the most potential to overlap with recently completed, current, ongoing, or foreseeable future projects that may affect aquatic resources. The other TAAs have much lower potential for impacts that could combine with other projects on the MBS because so little of the riparian reserve would be proposed for treatment in all alternatives, or there is no overlap within the TAAs that could cause a cumulative impact.

Vegetation management in TAA 2, 3, 4, and 16, may overlap with invasive plant treatments in riparian reserves. Riparian reserve conditions would be maintained and invasive plant treatment would help restore native plant communities disturbed by the vegetation management. Short term and localized adverse impacts to fisheries could occur from these projects, however projects would not jeopardize any aquatic species. Recreation management projects in TAA 23, 27, 33, 45, and 49 are unlikely to adversely affect aquatic organisms or combine with invasive plant treatments to cause any cumulative impacts to fish.

Road projects (mainly repair and closure) in TAA 20, 23, 32, 33, 45 and 49 would help improve fish habitat recovery over the long run. The effects of invasive plant management would not combine with the effects of the road projects to cause any adverse cumulative effects on fish. Stream restoration in TAA 32 would also serve to improve fish habitat and invasive plant treatment would contribute to beneficial cumulative effects.

Some sediment may also be delivered to streams, especially from manual treatment methods in all alternatives. The sediment could combine with sediment generated from other projects and reach streams. However, sediment is not likely to accumulate and impact water resources because (1) native vegetation would be retained on all sites and impacts from the project to any stream system would be minimal and short-lived and (2) sediment delivery is mitigated in other Forest Service projects.

3.8.4 Consistency with Regulations, Policies and Plans

All alternatives would be consistent with regulations, policies and plans associated with management of aquatic organisms and aquatic habitats.

3.8.4.1 Aquatic Conservation Strategy

Treatment of invasive plants is consistent with recommendations in watershed analysis done for watersheds on the Mt. Baker-Snoqualmie National Forest. Invasive plant treatments in the scope of this document are not likely to retard achievement of ACS objectives because the scale of treatment is small and the potential for harm is low. Chemical treatment within riparian reserves (approximately 2,140 acres) would not prevent attainment of ACS objectives and would the requirement that herbicide sand other chemicals be applied in a manner that avoids impacts that retard or prevent attainment of Aquatic Conservation Strategy objectives.

- Approximately 4,000 acres of the MBS across all watersheds (1.2 million acres) are currently infested.
- Less than 250 acres of MBS within any single 5th field watershed are currently infested.

An analysis of each alternative relative to ACS objectives is in the following section.

Aquatic Conservation Objectives

The following discussion is focused on the existing condition relative to invasive plants in the treatment analysis areas and their impact on meeting ACS objectives.

1. Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.

> *All alternatives would restore the diversity of watershed scale features by removing invasive plants found growing adjacent to or within aquatic influence areas. Alternatives 2 and 3 would be more effective due to a broader range of tools available to treat invasive plants.*

2. Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.

> *All alternatives would not likely affect chemical or physical routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species. The amount of treatment in any given watershed is small.*
>
> *Some invasive plant treatments can have positive effects on floodplains and stream banks when infestations of invasive plants on valley bottom areas are removed. Valley-bottom infestations often encroach floodplains where road-related and recreational activities have led to the establishment of invasive plant populations. Removal of such infestations is expected to benefit aquatic and terrestrial communities in the long term by increasing floodplain area available for nutrient, sediment and large wood storage, and flood flow refugia.*
>
> *Invasive plant treatments would not create physical barriers or otherwise degrade access to aquatic habitat.*

3. Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

All alternatives would restore the physical integrity of shorelines and stream banks by replacing invasive plants with native plant communities. The types of treatments proposed could result in minor stream bank erosion, but since no heavy equipment would be used, impacts would be localized and short-lived. There is no risk of negatively impacting channel condition and dynamics as a result of treating invasive plants.

4. Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

The extent and range of infestations currently found in aquatic influence zones is relatively small. No more than 10 acres would be treated within any 1.5 miles of stream. The amount of treatment that could occur annually in aquatic influence zones is limited by mitigation measures so that future treatments under EDRR would not result in greater potential effects. Some herbicide may enter water bodies, but not in quantities sufficient to reduce water quality at any scale.

5. Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.

Treatment of invasive plants has a low probability for producing sediment because very little ground disturbance would take place when invasive plants are treated with spot-spray or hand applications. Manual, mechanical, and restoration treatments are extremely unlikely to contribute sediment. The integration of manual/mechanical/herbicide treatments would limit the potential for excessive trampling and not solely rely on manual labor. Manual labor such as hand pulling and the use of mechanical equipment to control invasive plants may result in localized soil disturbance, but increases of sediment to streams would likely be undetectable. Not all vegetation in a treated area would be pulled or removed, so some ground cover plants would remain. Hand pulling is very labor intensive and costly. Thus, few acres per year could be treated using this technique across a watershed. The amount of sediment created by manual, mechanical, and restoration treatments is anticipated to be insignificant because the methods of treatments do not include ground disturbing activities by heavy equipment. When compared to the total acres within a watershed, project-related soil disturbance from hand pulling would be negligible.

6. Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.

Invasive plants can change stand structure and alter future inputs of wood and leaves that provide the basic foundation of the aquatic ecosystem food webs. Hydrologic changes from invasive plant treatments would never be large enough to cause effects at a sub-watershed scale. There is no risk of increasing water yield at any scale as a result of treating invasive plants.

Removal of invasive plants and replacement with native plant communities would restore future inputs of wood and leaves that provide the basic foundation of the aquatic ecosystem food webs. Treatment of invasive plants in riparian reserves would not impact current wood debris in streams.

7. Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

> *Removal of invasive plants and replacement with native plant communities would restore floodplain habitat and water table elevation in meadows and wetlands.*

8. Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.

> *Removal of invasive plants and replacement with native plant communities would restore species composition and structural diversity in riparian areas and wetlands. Herbicide application near streams may result in some minor non-target vegetation impacts at the site scale; however, the amount of herbicide that could contact streams would not be enough to alter non-target species or structural diversity.*

9. Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.

> *Native vegetation growth may change as a result of infestation, and the type and quality of litter fall, and quality of organic matter may decline, which can alter or degrade habitat for aquatic organisms. Removal of invasive plants and replacement with native plant communities would restore habitat for species dependent on riparian and aquatic habitats. The use aquatic glyphosate, aquatic imazapyr, and aminopyralid near wet streams may result in some minor non-target vegetation impacts at the site scale. However, the amount necessary to affect to affect habitat for populations of plants, invertebrates and vertebrates in riparian areas is not possible with spot-spray applications.*

3.8.4.2 Key Watersheds

Invasive plant treatment is proposed to occur in many Tier 1 Key Watersheds on the MBS. Key watersheds were designated under the Northwest Forest Plan to highlight areas that are necessary refugia for at risk fish species.

3.8.4.3 ESA Listed Fish and Habitat

Due to the minor ground disturbance and potential to disturb an individual fish, all alternatives "may affect" federally listed fish species (or those proposed for listing) or their designated critical habitat.[30] The following section summarizes analysis relevant to this ESA finding.

Primary Constituent Elements (PCE) were analyzed for critical freshwater habitats include spawning sites, rearing sites, and migration corridors. In 1996, NMFS developed a methodology for making ESA determinations for individual or grouped activities at the watershed scale, termed the "Habitat Approach". A Matrix of Pathways and Indicators (MPI) was also recommended under the Habitat Approach to assist with analyzing effects to listed species.

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[30] Results of the biological assessment indicates that invasive Plant Treatment on the Mt. Baker Snoqualmie National Forest may affect and is likely to adversely affect bull trout, Puget Sound Chinook salmon, Puget Sound steelhead and their designated or proposed critical habitat. The draft EIS erroneously indicated that the ESA determination was "not likely to adversely affect" for some listed species.

When using the MPI, project effects to the "Pathways and Indicators" (numeric ratings or narrative descriptors for each Pathway) are used to determine whether proposed actions would damage habitat or retard the progress of habitat recovering towards properly functioning condition. The Habitat Approach's MPI has numerous habitat-associated Indicators that closely "cross-walk" with the PCE's associated with designated critical habitat (Sept. 2002 designation letter). Table 58 displays the PCE – MPI Crosswalk.

Table 58. Crosswalk of PCE elements and MPI indicators

Primary Constituent Elements	Matrix of Pathways and Indicators
Spawning Habitat, as defined by water quality, water quantity, substrate	Water Quality: Temperature, Suspended Sediment, Substrate, Chemical Contaminants and Nutrients Flow/Hydrology: Change in Peak/Base flows Habitat Elements: Substrate/Embeddedness
Rearing as defined by adequate water quantity and floodplain connectivity	Channel Conditions and Dynamics: Floodplain connectivity Flow/Hydrology: Change in Peak/Base flow
Rearing as defined by adequate water quality and forage	Water Quality: Temperature, Substrate Habitat Elements: Large Woody Debris, Pool Frequency and Quality, Off-channel Habitat
Rearing as defined by adequate natural cover	Habitat Elements: Large Woody Debris, Pool Frequency and Quality, Large Pools, Off-channel Habitat
Migration as defined by habitat free of artificial obstructions, and adequate water quality, water quantity, and natural cover	Habitat Access: Physical Barriers Water Quality: Temperature Flow/Hydrology: Change in Peak/Base flow Habitat Elements: Large Woody Debris, Pool Frequency and Quality, Large Pools

All of these aquatic ecosystem components were evaluated in detail in the BA. The results of the detailed analysis indicate that there would be no detectable changes to temperature, floodplain connectivity, stream flow, pool frequency and quality, wood routing, or substrate from the treatments proposed. Invasive plant treatments may result in minor ground disturbance and localized sedimentation (see Chapter 3.4), but the amount of sediment is expected to be negligible and within the range of natural variability. Herbicide treatments may result in herbicide drift, run-off or leaching to streams, but the potential amount is very low given the MR/MM and buffers. The MR/MM and buffers minimize the risk of herbicide delivery to streams and limit the extent, intensity and frequency of treatment to reduce the likelihood of adverse effects actually occurring.

Invasive plants have some negative impacts on these aquatic ecosystem components (see discussion under Affected Environment). However, invasive plant treatments would have many beneficial effects on critical habitat for federally listed fish species by increasing native vegetation growth, cover and food. Invasive plant treatments conducted in riparian areas would help restore or maintain the native riparian vegetation that is essential in maintaining the PCE of critical habitat in the long-term.

Consultation has been completed with the NMFS for Puget Sound chinook and steelhead and is underway with the USFWS for bull trout. A decision for this project will not be signed until consultation has been completed.

3.8.4.4 Effects on Essential Fish Habitat

The Magnuson-Stevens defines adverse effects as any impact, which reduces the quality and/or quantity of Essential Fish Habitat (EFH). Non-herbicide and herbicide treatment methods would not impact those waters necessary for spawning, breeding, feeding, or growth to maturity because there is no treatment of submerged invasive plants and the predicted amount of herbicide coming in contact with water is expected to be below levels of concern or non-detectable. The quantity of EFH would not be reduced and the quality of EFH would be maintained by all alternatives.

3.8.4.5 Effects on Sensitive Fish Species

Coho salmon. Some herbicide treatments could occur alongside channels or ponds while juvenile coho are rearing. However, there is low potential for herbicide exposure above a level of concern to coho. Non-lethal effects to juvenile fish from low-level exposure is not well understood.

Coastal cutthroat trout. Herbicides would not be applied during peak spawning periods because these occur in winter and invasive plant treatments do not occur this time of year. Some disturbance and loss of individual non-target plants could occur in smaller streams. The extent of treatment along stream margins containing coastal cutthroat trout would be small compared to the available habitat for this species.

3.8.4.6 Effects on Management Indicator Species Fishes

The MBS Forest Plan identifies a number of fish species as Management Indicator Species (MIS) for healthy stream/riparian habitats. These include the coastal cutthroat trout, rainbow trout, bull trout, steelhead, Chinook, coho, sockeye, chum and pink salmon (USDA Forest Service 1990).

Riparian ecosystems occur at the margins of standing and flowing water, including intermittent stream channels, ephemeral ponds, and wetlands. The aquatic MIS were selected to indicate healthy stream and riparian ecosystems across the landscape. Attributes of a healthy aquatic ecosystem includes: cold and clean water; clean channel substrates; stable stream banks; healthy streamside vegetation; complex channel habitat created by large wood, cobles, boulders, streamside vegetation, and undercut banks; deep pools; and waterways free of barriers. Healthy riparian areas maintain adequate temperature regulation, nutrient cycles, natural erosion rates, and provide for in stream wood recruitment.

Habitat for each MIS species exists within the analysis area. Table 60 describes the MIS, the habitat they represent, and whether they are present in the project analysis area.

Table 59. Miles of documented presence on the MBS by management indicator fish species

Management Indicator Fish Species	Miles of Documented Presence on the MBS[1]
Chinook salmon (*Oncorhynchus tshawytscha*)	106
Bull trout (*Salvelinus confluentus*)	560
Steelhead (*Oncorhynchus mykiss*)	379
Coho salmon (*Oncorhynchus kisutch*)	524
Pink salmon (*Oncorhynchus gorbuscha*)	220
Chum salmon (*Oncorhynchus keta*)	121
Sockeye salmon (*Oncorhynchus nerka*)	158
Coastal cutthroat trout (*Oncorhynchus clarkii*)	763
Rainbow trout (*Oncorhynchus mykiss*)	503

[1] WDFW 2002; does not include miles on National Forest System land with “suspected” occupancy, or on other land ownerships.

Table 60. MIS and habitat description for the analysis area

Management Indicator Fish Species	Habitat Description	Habitat Present in Analysis Area	Species Present in Analysis Area
Coastal cutthroat trout	Streams/riparian habitats	Yes	Yes
Rainbow trout		Yes	Yes
Steelhead		Yes	Yes
Chinook salmon		Yes	Yes
Coho salmon		Yes	Yes
Sockeye salmon		Yes	Yes
Chum salmon		Yes	Yes
Pink salmon		Yes	Yes
Bull trout		Yes	Yes

Source: WDFW (2002).

In general, all of the aquatic MIS selected for the MBS have similar stream and riparian ecosystem requirements. However, they do represent a range of minor differences in habitat conditions found and utilized across the forest. As an example, bull trout require slightly colder water when compared to rainbow trout. Because the habitat requirements for each species are generally similar and often overlap, they were collectively chosen to represent healthy stream and riparian ecosystems.

Applications of aquatic glyphosate aminopyralid (Alternative 2 only), clopyralid, imazapic, aquatic imazapyr and metsulfuron methyl may be applied within ditches and dry intermittent channels. Based on the information presented above, it is reasonable to assume that aquatic organisms may be briefly exposed to higher levels of glyphosate or other herbicide compounds if an unexpected rainfall event occurs shortly after an application. To be exposed, individuals would need to be near the confluence where a ditch or intermittent stream channel is located when the "first flush" event occurred.

Even under the unlikely event that MIS fishes were exposed under the above scenario, effects would be limited to individuals. Mitigation measures that limit the extent of treatment within any given 6th field sub-watershed would ensure that large scale effects that could influence MIS fish at the population level could not occur.

3.9 Recreation, Wilderness and Wild & Scenic Rivers

3.9.1 Introduction

The analysis area for direct, indirect, and cumulative effects on the recreation, wilderness and Wild & Scenic River System resources is the current observed invasive plant sites along with expected spread within road corridors, recreation sites, administrative sites, wilderness areas, and portions of river passages, including the Skagit Wild and Scenic River System.

The project duration is 10 years or longer with the potential for repeated treatments (manual, mechanical or chemical) in sequential years or the same year on the same ground. There is the potential, under the proposed action that a given site would be impacted for at least 10 years and whatever recovery time necessary after that to mitigate the effects of soil disturbance or persistence of various chemical herbicides. The proposed action also provides for additional treatment of new infestations.

Recreation, Wilderness and Wild and Scenic River System analysis focuses primarily on the recreational environment and visitors. The herbicides proposed for use have a very low potential to cause human health issues at the concentrations and amounts which are proposed (see Chapter 3.3). The relatively small number of scoping responses for this project may indicate that people are not opposed to use of herbicides for invasive plant treatment on the MBS. Many people use various "weed killers" on their own properties at levels and frequencies much higher than is being proposed here. Nonetheless, some people have expressed concern about herbicide exposure and do not support herbicide use on the MBS.

Notification would be tiered based on the possibility of exposure to the public from the use of herbicides. For example, virtually the entire length of the Skagit River system is lined by invasive species of one type or another. However, public use of the shoreline is relatively low and dispersed. Some users float the river in boats so their exposure is limited to put-ins and take-outs. In contrast, people may live at their recreation residence for much of the year. Since all of the recreation residences are under permit, the owners can be easily contacted and informed of the timing and effects of a treatment. On the other hand, the angler who is passing through a riverside knotweed plant patch in a general forest area would be very difficult to contact ahead of time, other than posting notices on the internet, or near the treatment site. With this in mind, notification would be provided as indicated in the Management Requirements and Mitigation Measures table.

3.9.2 Affected Environment

3.9.2.1 Wilderness Areas

The MBS is home to nine wilderness areas covering about 830,000 acres. Approximately 48 percent of the Forest is within designated wilderness. The MBS shares administration of the Norse Peak, Alpine Lakes, Henry M. Jackson, and Glacier Peak Wildernesses with the Okanogan and Wenatchee National Forests. While large portions of these areas are relatively free of invasive plants, the trail systems and old roads and logging area landings within wilderness are likely to have invasive plants. Invasive plants have the potential to cause adverse impacts to wilderness character by disrupting the natural processes and untrammeled nature for which these areas were designated. Volunteers are helping the Forest Service inventory invasive plants throughout Mt. Baker-Snoqualmie wilderness areas.

Six infested sites are located in wilderness areas, within two Treatment Analysis Areas (TAA). One site is in the Glacier Peak Wilderness and five are in Wild Sky Wilderness.

TAA #19 has three sites within the Wild Sky Wilderness. The sites are along a segment of the North Fork Skykomish Road 63 which is now part of the North Fork Skykomish Trail # 1051.

TAA #53 extends along the Suiattle Trail into the Glacier Peak Wilderness Area. A known site occurs within the Wilderness boundary at an old trailhead that has been highly disturbed by stock use, beyond the junction with the Milk Creek trail.

Four other TAAs extend into Wilderness Areas, but do not have any mapped sites at this time.

- TAA #16 includes about 1 mile of Road # 6510-210 that extends about 1 mile into the Wild Sky Wilderness .
- TAA #17 includes 0.75 mile of the end of road 6546 that is in Wild Sky Wilderness.
- TAA #18 includes about 1 mile of the end of road 6530 that is in Wild Sky Wilderness. Recently, oxeye daisy, birdsfoot trefoil, and foxglove were recently identified on the disturbed roadside. These infestations are not included in the infested acreage within Treatment Analysis Areas (Table 18).

- TAA #54 includes the Johnson Ridge Trail # 1067 and spur to Joan Lake#1067.1. No invasive plant sites are mapped along these trails (which are in the Wild Sky and Henry Jackson Wilderness Areas). However, Scotch broom, St. Johnswort, common tansy and birdsfoot trefoil were recently identified along the first half-mile of the trail. These invasive species have the potential to spread further along onto the Johnson Ridge trail and into the Wild Sky Wilderness on NFS Trail # 1067. These infestations are not included in the infested acreage within Treatment Analysis Areas (Table 18).

The designation of Wild Sky Wilderness in 2008 included within its borders approximately 34 miles of system roads, some that were drivable in a passenger vehicle. Additional roads and railroad grades that had previously been removed from the road system cover many more miles. Most of the old roads within the Wild Sky Wilderness have not been surveyed for invasive plants. About 10 logging landings have been identified within the area now designated as wilderness which could potentially contain more invasive plant sites. Within the Mt. Baker Wilderness, 1.2 miles of the Lone Jack Mine road have also not been surveyed.

3.9.2.2 Skagit Wild and Scenic River System

The only designated Wild and Scenic River system designated on the Forest is the Skagit. The Skagit system includes portions of the Skagit, Cascade, Sauk and Suiattle Rivers and covers approximately 150 river miles. Most of the other major river systems on the Forest have been determined to be eligible for inclusion in the Wild and Scenic River System in the Forest Plan. At present, legislation is pending in Congress that would add both the Illabot and Pratt Rivers to the system.

The location of roads along nearly the entire river corridor has allowed for numerous invasive plants to become established. Approximately 93 infested sites (1,433 acres) have been mapped within the Skagit Wild and Scenic River System. The overriding resource value being managed for all of the river segments is scenery. A River Management Plan was developed for the Skagit River and incorporated into the Forest Plan. The Plan does not speak directly to non-native vegetation. However, since preservation of the scenery and natural character of the river is paramount, it is assumed that protection of the native plant species is desirable.

3.9.2.3 Recreation Areas

Municipal watersheds, dispersed and developed recreation areas (trailheads, campgrounds, picnic areas, boat ramps, ski areas, public service centers, recreation residences, etc.) and special forest product collection areas currently occur in the vicinity of invasive plant sites. Infested sites are scattered and occupy about one-third of 1 percent of the MBS. The number of infested sites and acreage within various types of recreation areas is shown in Table 61.

Table 61. Infested acreage and numbers of sites within Recreation Areas

Site Type	Number of sites (all species)	Infested Acres
Administrative Site	31	70.5
Recreation Residence	9	0.3
Campground	24	44.8
Picnic Area	8	122.9
Viewpoint	6	97.2
Lake Shore	14	1.3
Boat Launch	1	0.2
Trailheads	12	7.8

Site Type	Number of sites (all species)	Infested Acres
Trails - Wilderness	6	4
Wild and Scenic River	93	1,433
Total	**205**	**1,896**

Note: Co-located invasive species are tallied separately.

Forest Product Gathering

All kinds of people gather special forest products such as blackberries, huckleberries, salal, mushrooms, ferns bear grass and herbs for personal use and commercial sale. Some of these products are invasive species, such as blackberries and St. Johnswort, but most are not.

Trails

The Forest Trail system comprises a total of about 1,600 miles. Less than half is open to use by stock animals and the majority of the stock accessible trails are located with wilderness. About 10 percent is open to motorized use and this is largely confined to the Evans Creek area at the extreme southern edge of the Forest. Much of the maintained portion of the trail system receives very heavy use by hikers that extends throughout the year on some trails that have low elevation access. Stock users comprise fewer than 5 percent of the total trail users. Trail maintenance along with invasive plant treatments would reduce source populations and therefore the spread and amount of resources expended in containing invasive species expansion.

Use of the trail system has been increasing with the growing population in the Puget Sound area. Most of the increase has been in day hiking, though interest and demand for mountain biking is rising. Near the major paved highway corridors there are also expanding networks of user, or boot built, trails developing that access mountain peaks, lakes and viewpoints. The relationship between OHV, trail use, travel management, and the introduction, establishment and spread of invasive plants was discussed in the R6 2005 FEIS (Chapter 3.1.3, Mechanisms of Invasion), and recognized that OHV use can influence the spread of invasive plants by disturbing soil and carrying seed several orders of magnitude greater than ‘conventional’ dispersal methods (R6 2005 FEIS p. 3-15). Available resources for maintenance, storm damage, and other factors limit annual maintenance to about half of the total system. Recent field visits by a botanist revealed unmapped invasive plants along some wilderness trails.

Motorized Access

Heavy vegetation and steep terrain throughout the Forest effectively constrains motorized use to the existing road system, a handful of trails, and an even smaller group of cross country areas. Forest Orders have been in place for many years that prohibit use of OHV’s to a limited trail system. The Motor Vehicle Use Map (MVUM) designated roads and trails that are open to motorized use. No motorized use is allowed outside these areas. The MVUM also prohibits use of motor vehicles beyond 150 feet from the centerline of Forest Roads.

The road system on the Forest has been shrinking since its peak in the late 1980s. This is due, largely, to the scaling back of the timber program and reduced funding for road maintenance. Growth of native vegetation over Maintenance Level 1 roads has reduced access along several hundred miles of those roads. Damage from major storms have also reduced access to large portions of several major drainages including the Suiattle, White Chuck, Canyon Creek (Stilly), North Fork Skykomish, and West Fork White Rivers. While some access has been restored, and more will be, these road networks will not be restored to their previous extents. Currently, the Forest road system includes about 2,600 miles. About 800 miles have been closed or are in storage. Funding is available to maintain about 33 percent of the open-road system.

3.9.3 Environmental Consequences

3.9.3.1 Direct and Indirect Effects of Alternative 1 – No Action

Effects on Wilderness and Skagit Wild and Scenic River

No herbicide treatment would occur in the wilderness under Alternative 1. Some manual treatment may occur. Invasive plants would likely continue to grow and spread in wilderness and along the Wild and Scenic Rivers, which would have the potential to disrupt natural processes. The scenic integrity could be reduced and wilderness character could be adversely impacted by invasive plant expansion into native plant communities. Of the three alternatives, No Action has the greatest potential to affect wilderness values because wilderness would not be treated effectively.

No Action may also not be sufficient to fully maintain the native species in the Wild and Scenic River System. Treatments that are currently approved have not kept up with treatment needs, which may result in reduced plant diversity and a loss of scenic value.

Recreation and Scenic Resources

Invasive plant treatments that are currently approved may affect scenic resources. Visitors may note temporary impacts to scenery if large numbers of target plants are treated at once and are seen in the dying or dead phase. By the following growing season, no evidence would remain when the residual live, green, native vegetation once again dominates the view. No adverse effects on recreation users or recreation/scenic resources have been reported from invasive plant treatments that have been implemented since 2005. Recreation users do not appear to have been displaced by treatments, and the treatments have not led to visual impacts in the form of large areas of dead plants or de-vegetated zones along visually sensitive road corridors. Forest product gatherers have not reported negative effects of current treatments. Human health would not be adversely affected by herbicide use under No Action (see Chapter 3.3).

With No Action, invasive plants would not be effectively treated in some recreation areas. Potential effects on scenic views could result from invasive plant spread shifting the landscape character to a more homogeneous species composition. This impact on species composition within particular areas and in the forest understory could be inconsistent with the valued landscape character in places where invasive plants are not effectively treated. The No-Action Alternative has not effectively kept up with invasive plant spread, reducing habitat quality for native plants (see Chapter 3.3), wildlife (Chapter 3.5) and fish (Chapter 3.8).

The holders of special use permits for recreation residences on the Forest are familiar with the problem of invasive plants like English ivy and knotweed and have been actively engaged in efforts to control the plants around their cabins.

3.9.3.2 Direct and Indirect Effects of Alternatives 2 and 3

Effects on Wilderness Areas and Skagit Wild and Scenic River

Effects to wilderness areas and the Skagit Wild and Scenic River are similar between Alternatives 2 and 3. The Forest Plan Amendment to add aminopyralid in Alternative 2 would increase treatment cost-effectiveness and minimize adverse effects to fish and wildlife compared to Alternative 3, however at the project scale, this would be unlikely to result in substantial differences in effects to wilderness or the Skagit Wild and Scenic River area.

Spot and selective herbicide applications, along with manual treatments such as hand pulling, would occur as needed in wilderness areas in Alternatives 2 and 3. These treatment methods would affect wilderness character, both enhancing and potentially distracting from the untrammeled nature desired within wilderness. Wilderness visitors may notice vegetation that has been browned by treatment, yet for many it may not be obvious. A visitor's sense of solitude may be affected if they encounter an invasive plant worker pulling or spraying invasive plants. These encounters would be brief, and no mechanized treatment methods would be approved for wilderness application.

Eradication of invasive plants would allow vegetation within wilderness areas to evolve in a more natural way, which would promote the untrammeled character of wilderness. Both action alternatives would more effectively treat invasive plants in wilderness and wild and scenic river areas than No Action. The use of aminopyralid in Alternative 2 would increase the effectiveness of treatment for many target species, especially near streams (Chapter 3.3).

Invasive plant treatments could also affect scenery within the Skagit Wild and Scenic River system, especially if the entire area is treated at one time. However, these effects would be temporary and by the following growing season, native vegetation would recover.

Use of more selective herbicides (e.g., aminopyralid in Alternative 2, chlorsulfuron in both action alternatives) could reduce the potential damage to common non-target plants growing with the invasive plants compared to No Action. Effects to outstandingly remarkable values would be minimal given the MR/MM and herbicide use buffers (Chapters 3.4, 3.5, 3.7 and 3.8). In the long run, treatment of invasive plant and restoration of treated areas would enhance wilderness and Wild and Scenic River values. Alternative 2 would be more favorable to Wild and Scenic River values because of the increased effectiveness and selectivity associated with use of aminopyralid.

Effects on Recreation and Scenic Resources

Both action alternatives would maintain or improve recreation and scenic resources. Compared to No Action, more effective treatment would better maintain scenic values by supporting a diverse visual mosaic of native grasses, forbs, and shrubs consistent with the ecological setting. The additional herbicide choices in both action alternatives would leave more of the native vegetation intact than would be likely with non-selective herbicides such as glyphosate (Chapter 3.4). Existing visual quality objectives would be met and changes to the scenic integrity and stability would be minimized. Dead vegetation that would be visible for at least one growing season and could result in short-term negative effects to the scenery. The unnatural appearance of mowed and brushed areas seen from immediate foreground distances (300 feet) would also be a short-term negative effect. Some treatment areas stretch for miles along the sides of roads. However, in the long run, compared to No Action, more effective restoration of native vegetation would better maintain or increase scenic integrity.

Herbicide and manual treatments of invasive plants would continue in campground and recreation residence tracts. The Forest would utilize a notification process so people know in advance what plants are to be treated, so that people can avoid areas that have been sprayed. A potential negative effect anticipated is if some forest visitors feel they must go elsewhere to avoid herbicides that have been applied to invasive plants in their favorite recreation spot.

No adverse effects to the recreating public are anticipated from changes to the herbicide use proposed in the action alternatives. The use of triclopyr in both action alternatives poses minor risk to forest product gatherers or other Forest visitors, however, the MR/MM reduce the potential for these effects to actually occur (Chapter 3.3).

3.9.3.3 Cumulative Effects of All Alternatives

The cumulative effects are the same in all alternatives. Recreation use on the Forest is projected to increase, which both creates more potential for spreading of invasive plants and potential for impacts to recreation users from invasive plant treatment.

The use of herbicides off National Forest could result in multiple or additive doses of the same or different herbicides to the recreating public. Forest visitors or workers could conceivably be exposed to herbicides in more than one place on the Forest, or elsewhere. However, the herbicides proposed for use do not bioaccumulate in humans and are rapidly eliminated from the body, thus cumulative effects to the public are not likely (Chapter 3.3 - Human Health). Use of herbicides off national forest would not contribute to adverse cumulative effects on recreation or scenic resources within the Forest.

The list of recently completed, current or ongoing, and foreseeable future projects on the Forest was reviewed. While many projects overlap with dispersed recreation sites, the effects are unlikely to combine with this project and cause a cumulative effect. None of these recently completed, currently being implemented, ongoing or foreseeable future projects on the MBS involve the use of herbicide, thus they would not contribute to cumulative herbicide exposure or herbicide effects on recreation or scenic resources.

Effective invasive plant treatment would reduce invasive species source populations and assist in maintaining desired resource values on the Forest. This beneficial impact could combine with other beneficial activities on recreation and scenic resources.

Wilderness and Wild and Scenic River Values

About 830,000 acres (48 percent) of the MBS are designated as wilderness. About 600 miles of trail traverse these areas, of which about 340 miles are currently open to stock animals. Due to storm damage, reductions in wilderness trail maintenance and less use by stock animals, the system available to stock animals is near an historic low. Introduction of invasive plants to wilderness areas may have preceded their designation as wilderness and occurred during a time when use of the Forest by stock animals, including grazing allotments, was far greater than at present. As many of the best grazing areas were near the Cascade Crest, trails which accessed those allotments passed through most of the Forest to reach them. Some invasive plants were likely introduced in this manner.

In recent decades elimination of commercial grazing allotments, reduced use of pack stock on trails along with benign neglect, has likely reduced the quantity of seeds being transported into the wilderness and backcountry areas of the Forest. While wilderness management activities would continue, the likelihood of invasive plants spreading further from management activities with the proposed control mechanisms is not expected.

No cumulative effects to wild and scenic river values are anticipated. All projects proposed in wild and scenic rivers would be designed to maintain the outstandingly remarkable values for which the river has been designated.

Habitat restoration could overlap with invasive plant treatments in wilderness in rapid response actions that would be relatively small site specific projects less than 1 acre in size (campsite restoration or trail reconfiguration). Habitat restoration would overlap with invasive treatments on the Skagit Wild and Scenic River at boat launches or other sites with invasive weeds. No negative cumulative impacts on wilderness, recreation or Wild and Scenic River values can be discerned when impacts from this project are combined with impacts of habitat restoration. Reduced invasive populations on trails would assist in maintaining wilderness character and Wild and Scenic River values.

Roads and Trails

Forest Service projections suggest increased Forest recreation use of open roads and trails, both motorized and non-motorized which would continue to be conduits for the distribution of invasive plants. It is likely that a somewhat reduced system of roads and trails will minimize that portion of the Forest where invasive plants could be introduced, along with management actions such as the Regional requirement that any fee for stock animals be certified weed-free on all national forests in the Pacific Northwest Region. Future foreseeable actions include site-specific trail improvement projects. This work would primarily be trail restoration, bridge replacement and intensive maintenance work. Currently, an average of two new major trail bridges may be built each year along with 2 miles of relocated trails. While trail maintenance would continue to provide distribution avenues for invasive species, the proposed treatments would reduce current source populations of known invasive species, and limit the future spread and amount of resources expended in containing invasive species expansion.

While designated routes open to motorized use and dispersed camping would continue, the likelihood of invasive plants spreading further from these sites with the proposed control mechanisms is not expected (Chapter 3.3 - Botany). Cumulatively, open roads and road maintenance operations would continue to provide a conduit for invasive species introduction, with invasive plant treatments reducing the current source populations and therefore the spread of invasive species. This would allow for fewer resources needed for treatment in the future.

Administrative and Recreation Sites

Administrative and recreation site management projects would overlap with the Invasive Plant project. The cumulative effects analysis area contains all administrative, developed and dispersed recreation sites on the Forest. No negative cumulative impacts on users or environmental values can be discerned when impacts from this project are combined with impacts of site management. Coordination between invasive plant treatments and administrative and recreation site management would occur to reduce the potential adverse effects to Forest visitors.

Consistency with Regulations, Policies and Plans

This project is consistent with regulations, policies and plans associated with recreation management.

3.10 Heritage Resources

3.10.1 Introduction

Many laws, policies, regulations and agreements provide specific management direction for protection of prehistoric and historic resources and tribal treaty rights.

The Antiquities Act of 1906. The Antiquities Act (P.L. 59-209, 16 U.S.C. 431-433) authorizes a permit system for investigation of archaeological sites on federal lands and allows the President to establish national monuments on federal lands in order to protect them.

Historic Sites Act of 1935 (16 USC 461). The Historic Sites Act declares national policy to preserve for public use historic sites, buildings, and objects of national significance for the inspiration and benefit of the people of the United States.

The National Historic Preservation Act of 1966, as amended in 1992 (NHPA). The NHPA (P.L. 102-575; 16 U.S.C. 470) extends the policy of the Historic Sites Act to state and local historic sites as well as those of national significance. It established the federal government's policy and programs on historic preservation, including the National Register of Historic Places (NRHP).

The Archaeological Resources Protection Act of 1969 (ARPA). The ARPA prohibits disturbance or removal of archaeological resources from federal lands without a permit from the responsible land manager. ARPA applies to both NRHP-eligible and non-eligible sites that are at least 100 years old.

The American Indian Religious Freedom Act of 1978 (AIRFA). The AIRFA protects the rights of American Indian people to believe, express, and exercise their traditional religions. AIRFA allows access to sites, use and possession of sacred objects, and freedom of worship through traditional ceremonies and practices. It also requires a review, in consultation with American Indian leaders, of federal agency policies and programs to determine changes necessary to protect and preserve religious and cultural practices of American Indians.

The Native American Graves Protection and Repatriation Act of 1990 (NAGPRA). The NAGPRA establishes the rights of lineal descendants and members of Indian tribes to certain human remains and precisely defined cultural items recovered from federal or Indian lands. NAGPRA also establishes procedures and consultation requirements for intentional excavation or accidental discovery of American Indian remains or cultural items on federal or tribal lands.

Native American Graves Protection and Repatriation Regulations (43 CFR 10 Subpart B Human Remains, Funerary Objects, Sacred Objects, or Objects of Cultural Patrimony from Federal or Tribal Lands). These regulations carry out provisions of the NAGPRA of 1990. The regulations pertain to the identification and appropriate disposition of human remains, funerary objects and objects of cultural patrimony, and pertain whether they are inadvertently discovered or excavated intentionally under a federal permit (Antiquities Act or ARPA).

Executive Order 11593. The order directs federal agencies to inventory cultural resources under their jurisdiction, nominate all federally owned properties that meet the criteria of the NRHP, use due caution until the inventory and nomination processes are completed, and assure that federal plans and programs contribute to preservation and enhancement of non-federally owned properties.

Executive Order 13007. This order directs executive branch agencies to accommodate access to and ceremonial use of American Indian sacred sites by Indian religious practitioners and to avoid adversely affecting the physical integrity of such sacred sites on federal lands to the extent practicable, permitted by law, and not clearly inconsistent with essential agency functions. The agencies are further directed to ensure that reasonable notice is provided of proposed land actions or policies that may restrict future access to or ceremonial use of, or adversely affect the physical integrity of sacred sites.

Executive Order 13175. Consultation and coordination with Indian tribal governments – requires federal agencies such as the USDA Forest Service to develop an accountable process to ensure the meaningful and timely input by tribal officials in the development of regulatory policies that have substantial direct effects on one or more Indian tribes, on the relationship between the federal government and the Indian tribes, or on the distribution of power and responsibilities between the federal government and Indian tribes.

Executive Order 13287 – Preserve America. Issued in March of 2003, Executive Order 13287 established federal policy to provide leadership in preserving America's heritage by actively advancing the protection, enhancement and contemporary use of the historic properties owned by the federal government. The order encourages agencies to seek partnerships to make more efficient and informed use of historic properties for economic and other recognized public benefits.

Protection of Historic Properties 36 CFR 800. These regulations implement the NHPA Section 106 and define how federal agencies take into account the effects of their undertakings on historic properties. The regulations identify consulting parties, and identify the goal of consultation: to identify historic properties potentially affected by the undertaking, assess its effects, and seek ways to avoid, minimize or mitigate any adverse effects on historic properties (36 CFR 800.1).

National Register of Historic Places (36 CFR 60). These regulations establish the National Register of Historic Places as a planning tool to help federal agencies evaluate cultural resources in consultation with the State Historic Preservation Officer and the Advisory Council on Historic Preservation. 36 CFR 60.4 provides the criteria for determining whether cultural resources are eligible for listing on the NRHP.

Protection of Archaeological Resources Uniform Regulations (36 CFR 296). These regulations implement the ARPA by establishing uniform definitions, standards and procedures for federal land managers to follow in providing protection for archaeological resources located on public lands. The regulations define prohibited acts, and requirements for issuing permits under the authority of the ARPA.

U.S. Forest Service's Native American Policies. The Forest Service's Native American polices are described in Forest Service Manual 1563 and Forest Service Publication FS-446 and FS-600. The Forest Service's Native American policies include maintaining a governmental relationship with federally-recognized tribal governments, implementing programs and activities in a way that honors Indian treaty rights and fulfills legally-mandated trust responsibilities to the extent that they apply to National Forest system lands (NFSL), administering programs and activities to address and be sensitive to traditional native religious beliefs and practices, and providing research, transfer of technology, and technical assistance to tribal governments.

The Federal Trust Responsibility. The trust responsibility is the U.S. government's permanent legal obligation to exercise statutory and other legal authorities to protect tribal land, assets, resources, and treaty rights, as well as a duty to carry out the mandates of federal law with respect to American Indian and Alaska Native tribes (USDA Forest Service Publication FS-600). The Forest Service must carry out this responsibility to tribes while at the same time carrying out the intent of other federal laws, which the Forest Service has a similar duty to follow.

Treaties. The *Point Elliott and Medicine Creek Treaties* were negotiated by Territorial Governor Isaac Stevens with various western Washington native people in 1854-55. Lands administered by the MBS were ceded to the United States under these treaties. Courts have recognized certain rights as being "reserved" by tribes. Indian reserved rights continue to be exercised by tribes and their members today under tribal regulation and remain enforceable under the supremacy clause of the Constitution until extinguished by express congressional action. The Treaties of Point Elliott and Medicine Creek contain identical language describing off-reservation treaty-reserved rights:

> *The right of taking fish at usual and accustomed grounds and stations is further secured to said Indians in common with all citizens of the territory, and of erecting temporary houses for the purpose of curing, together with the privilege of hunting and gathering roots and berries on open and unclaimed lands. Provided, however, that they shall not take shellfish from any beds staked or cultivated by citizens.*

Yakama Treaty: The Mt. Baker-Snoqualmie administers some lands in Kittitas County (e.g. the Gold Creek Pond area) ceded to the United States under the Yakama Treaty. The Yakama Indian Nation reserved certain rights, similar to the rights reserved in the Treaties of Point Elliott and Medicine Creek, with the addition of the right of "pasturing their horses and cattle upon open and unclaimed land." In addition, the Yakama Indian Nation's usual and accustomed fishing places have been adjudicated by the

Court in United States v Washington, and include lands between the Skykomish River Basin and Mt. Rainer National Park that are administered by the MBS (USDI BIA 1978).

The Programmatic Agreement regarding cultural resource management on National Forests in the State of Washington was negotiated between USDA Forest Service Region 6, the Washington State Historic Preservation Officer (SHPO), and the Advisory Council on Historic Preservation (ACHP) (USDA Forest Service 1997). The Invasive Plant EIS project was reviewed under the terms of the Programmatic Agreement.

No field surveys were conducted for this analysis. This analysis addresses only invasive sites that were analyzed under this Invasive Plant EIS and treatment and restoration methods proposed as first year/first choice. If the treatment differs from the first year/first choice or the restoration differs from what is proposed and analyzed in the EIS, then the changes must be reviewed by a heritage specialist, and approved pursuant to the terms of the 1997 Programmatic Agreement (PA 1997).

Application of herbicides qualifies for review under the Appendix A of the Programmatic Agreement and may proceed without further consideration or consultation with the State Historic Preservation Officer (SHPO) (USDA Forest Service 1997: Appendix A).

Hand pulling of invasive plants also qualifies for review under Appendix A of the Programmatic Agreement, when the treatment site was in a plantation, road shoulder, or rock pit/stockpile location. At these locations, hand pulling may proceed without further consultation with the SHPO (USDA Forest Service 1997: Appendix A).

3.10.2 Affected Environment

This section describes the cultural setting, heritage resources, and reserved treaty rights as they relate to the project area.

3.10.2.1 Cultural Setting

Prehistoric Context

Evidence for human activity in inland western Washington starts approximately 10,000 to 12,000 years before present (B.P.), with no sites in Cascadia that are indisputably dated before about 13,000 B.P. (Ames & Maschner 1999:64). Due to highly acidic sediments, faunal remains, and bone and stone implements are not preserved, and sites from the riverine sector are characterized primarily by flaked stone artifacts (Nelson 1990). One proposed cultural sequence for the western Cascades is presented by Hollenbeck (1987:27-30), from which the following is drawn.

From 12,000-5,000 before present (B.P.), generalized hunting and gathering occurred. Following the glacial retreat, the landscape became available to highly mobile hunters and gatherers. People lived in small groups, occupying low or mid-elevations of the major river valleys during the colder months. For the remainder of the year settlement is postulated to have consisted of a semi-nomadic foraging pattern. Small groups established temporary base camps where they processed food and manufactured tools. From these camps they moved into the uplands of the Cascades, hunting, gathering, and possibly fishing.

From 5,000-2,500 B.P., development of specialized resource use was occurring. Differences between cultural development along the coast and the mountain regions become more pronounced as people adapt to varied resource availability and needs. An inland orientation develops in the Cascades, which is influenced by or related to cultural development in the Plateau region. Artifact styles similar to those of eastern Washington become more common, and this similarity continues through late prehistoric and ethno-historic times. A more complex system of trade is apparent. Increased contact and exchange with people from across the mountains during this period has been suggested.

From 2,500-250 B.P., specialized resource utilization occurred. By about 2,500 B.P., the climate became comparable to present conditions. Sites assigned to this period are considered to be representative of the fully developed subsistence activities of the ethnographic reports. In the Cascade foothills, these would include anadromous fishing of the major drainages, and land mammal hunting and plant gathering of most of the species used by the beginning of the ethno-historic period.

250 B.P – Present, was the ethno-historic period. This period is characterized in the material archaeological record by the addition of objects of European and Euro-American manufacture. Many traditional tools were replaced by imported ones. Some tools were rendered unnecessary by the introduction of manufactured goods, while other tools exhibited a melding of native and imported materials.

Ethno-historic Context

The following section is modified from Hollenbeck (1987:111,191).

At least eleven federally recognized Indian Tribes have occupied and regularly used the lands and resources which are now part of the Mt. Baker-Snoqualmie National Forest, including the Nooksack, Lummi, Samish, Swinomish, Upper Skagit, Sauk-Suiattle, Stillaguamish, Tulalip Tribes, Snoqualmie, Muckleshoot, and Puyallup. However, the lands of the Forest were not limited to the exclusive use of these tribes. This project also includes lands east of the Cascade crest that are part of the Okanogan-Wenatchee National Forest (administered by the Mt. Baker-Snoqualmie) that were utilized by the Yakama. Others, including residents of the inland Columbia Plateau, shared in the occupancy of these lands and the use of the resources.

The Native Americans of this region took part in a seasonal round of settlement and subsistence patterns that included visits to Puget Sound, the upriver environments, the mountain slopes and across the Cascades to fulfill social and economic requirements. There were optimum times for the exploitation of resources, and these determined the seasonal activities. Spring, summer and fall were the busiest times, when many species of plants, animals, and fish were available in quantity. Where several resources were available during the same time of year, the most efficient use of the procurement excursions was made. Hunting and gathering trips to the mountainous regions of the Cascades were often combined. Deer, elk, and goat hunting took place in the higher elevations in the fall. The gathering of huckleberries in the open areas of the mountain slopes and ridge tops was also a fall activity. Fish, the primary resource of western Washington tribes, were caught in the lakes, rivers and streams of the Forest.

Tribal territory was viewed as the land and resources regularly used by a particular group. The social and kinship ties, strengthened by the high frequency of intermarriage between the tribes, served to open up wider territory, and thus a greater variety and quantity of resources, to those who maintained them. The resource exchange was an integral part of the social and economic system.

In March 2, 1853 the Washington Territory was separated from Oregon Territory by an act of Congress, and Isaac Stevens took office as Territorial Governor and ex-officio Superintendent of Indian Affairs. One of the first tasks assigned to the new Governor was to extinguish all Indian title to the land, through the negotiation of treaties with the various Indian bands (Hollenbeck 1987:107). This ultimately resulted in the Treaty of Point Elliott, The Medicine Creek Treaty, and The Yakama Treaty, which among other items, created tribal reservations, and ceded all other lands occupied by Indian tribes and bands to the United States Government. However, certain rights were reserved for signatories to the treaty. Reserved treaty rights are discussed below in the Reserved Treaty Rights section.

Historic Context

The following section is modified from Hollenbeck (1987:317).

The history of the land that became the MBS begins in the early 1800s. The first reported non-native to pass through the forest was fur trapper and explorer Alexander Ross, who crossed the mountains at Cascade Pass in 1814. With the founding of Fort Nisqually in 1833, the Hudson Bay Trading Company had increasing influence in the Puget Sound Region and inland river drainages. Fur hunters and trappers were likely the only non-native visitors to the Forest for many decades. By the mid-1800s, Euro-American settlement of the Puget Sound Region was increasing.

Efforts to convert existing Indian and fur trapper trails into roads across the passes were launched (e.g. Naches Pass Wagon Road in 1850). In 1854, the President and the Secretary of War in Washington, D.C., authorized the railroad surveys. The earliest miners probably reached the area in the 1860s, eventually discovering and establishing 10 Mining Districts. By the late 1800's, the Forest was increasingly explored and settled by Euro-Americans. Mining and logging were the two main industries.

In 1897 the Washington Forest Reserve was established in the North Cascade Mountains and managed under the Department of the Interior. In 1905 they were transferred to the Department of Agriculture, and by 1908 the Forest Reserve was divided into two forests; the Washington National Forest (the name was later changed to Mt. Baker) and the Snoqualmie National Forest. Following the Great Depression, the Civilian Conservation Corps was established, and they worked within the forest from 1934 to 1942 on creating improvements in the forest, including new roads and trails, campgrounds, fire lookouts and reforestation projects. In 1973, the Mt. Baker National Forest was merged with the Snoqualmie National Forest into the Mt. Baker-Snoqualmie National Forest.

3.10.2.2 Cultural Resources Identified

GIS analysis revealed 104 heritage sites overlapping with 515 of the known invasive plant infestations. Thirty-three of these heritage sites were already determined not eligible for the National Register of Historic Places (NRHP). The remaining 71 invasive plant sites are within or near eligible or potentially eligible heritage sites. An additional 178 heritage sites are outside known infestations, but within Treatment Analysis Areas. Of these, 46 were already determined not eligible for the NRHP; the remaining 132 sites are eligible or potentially eligible for the NRHP.

Of the 71 heritage locations within infestations, 5 were identified as having some concern that one of the treatment types or restoration methods could potentially affect the resource. Of the 132 eligible or potentially eligible heritage locations outside of infestations, but within Treatment Analysis Areas, 80 were identified as having some concern that one of the proposed treatment types or restoration methods could potentially affect the resource.

The Forest's GIS layer for Native American religious use, practices, localities, and resources (Blukis Onat and Hollenbeck 1981), was compared to the Treatment Analysis Areas. Nine Treatment Analysis Areas were found to contain spiritual bathing sites.

3.10.2.3 Reserved Treaty Rights

The proposed project is located on lands ceded to the United States under the Treaty of Point Elliott, and the Medicine Creek Treaty. Treaty rights include rights specifically reserved in treaties signed by American Indian groups with the federal government as well as other rights not specifically taken away by treaty. They include, but are not limited to, the reserved rights to "fish at usual and accustomed grounds and stations" and "erecting temporary houses for the purpose of curing, together with the privilege of hunting and gathering roots and berries on open and unclaimed lands." Although "open and unclaimed lands" is not clearly defined, federal courts have ruled that certain federal public lands not set aside for uses incompatible these rights, such as National Forest System lands, are considered open and unclaimed for these purposes. Usual and accustomed grounds and stations have been adjudicated in court for federally recognized Indian tribes with reserved rights under these treaties, as well as the Yakama Treaty, on the Mt. Baker-Snoqualmie National Forest.

These reserved rights reflect the subsistence, medicinal and spiritual aspects of the traditional lifestyle of Northwest Indian people. They are as important to Indian Tribes today as they were when their ancestors reserved these rights in the Treaties. In addition, resources such as cedar, fish, large game, and huckleberries, have ceremonial importance and are central to the identity of American Indian Tribes.

3.10.3 Environmental Consequences

The analysis area for direct and indirect effects on Heritage Resources is the infested areas within the Treatment Analysis Areas. The area of analysis for reserved treaty rights is defined by the locations of specific resources such as salmon, wildlife and plants, discussed in various resource reports for this project.

3.10.3.1 Direct and Indirect Effects

Alternative 1- No Action

Under the No-Action Alternative , the MBS 2005 Decision Notice (MBS 2005 DN) would continue to guide invasive plant treatments and restoration within the project area.

Direct and Indirect Effects to Heritage Resources. The analysis for the MBS 2005 DN determined that the proposed treatments in 91 specific treatment sites had little to no potential to affect historic properties because each specific treatment action is reviewed by the heritage specialist pursuant to the PA (USDA Programmatic Agreement 1997). In the future, if expanded to the proposed 952 infestation sites of the current undertaking as well as the other areas within the Treatment Analysis Units, effects to historic properties would continue to be reviewed by the Heritage Specialist under the terms of the PA.

Direct and Indirect Effects to Reserved Treaty Rights. Treaty rights would remain unchanged under Alternative 1. The Forest sends an annual newsletter to Tribes to notify them of current treatment plans and new treatment locations. Since this process was implemented in 2005, the Forest has not received any objections or concerns from Tribes. Removal of invasive plant species increases the availability of indigenous species, a goal generally supported and encouraged by Tribal governments. Salmon and other fish, certain flora, and large game are treaty resources central to the culture of the Indian tribes and are discussed in detail in specific resource reports for this project.

Alternative 2- Proposed Action

Alternative 2 is the Proposed Action to update the current program and effectively contain, control or eradicate known invasive plants and those found in the future. Ground-disturbing treatments such as digging, pulling or restoration planting would be screened by a cultural resource specialist to ensure that no impact on cultural resources occurs. Digging is planned at 4 sites, hand pulling at 136 sites, and post-treatment restoration involving digging and planting vegetation at 44 sites. Two digging locations require survey prior to treatment, 1 hand pulling location requires survey prior to treatment, and 38 post-treatment planting locations need survey or further analysis prior to digging to plant vegetation. These sites are identified in the Project Record.

Direct and Indirect Effects to Heritage Resources. No direct or indirect effects to heritage resources were identified as a result of this analysis. This project was reviewed under the terms of the Programmatic

Agreement (PA), and excluded from case by case review by the SHPO (USDA Forest Service 1997; Appendices A & B). Mitigation measures reduce the likelihood that heritage resources would be affected during implementation of the project.

Direct and Indirect Effects to Reserved Treaty Rights. Treaty rights would remain unchanged under Alternative 2. Tribal notification and coloration of herbicides would reduce the potential for concerns regarding tribal gathering and invasive plant treatments. Effects to salmon and other fish, certain flora, and large game are discussed in detail in specific resource reports for this project.

Alternative 3 – No Aminopyralid (Milestone®)

Alternative 3 to responds to concerns about aminopyralid being a newer herbicide with less of a history than the others we propose to use. The available treatment would expand to follow the R6 2005 ROD standards and more effectively treat invasive plants but we would not amend the MBS Forest Plan and we would not use aminopyralid (trade name Milestone®). All of the Management requirements/Mitigation Measures, the Early Detection and Rapid Response approach and monitoring that are associated with the Proposed Action (Alternative 2) would apply to Alternative 3 except buffers and other measures that apply to aminopyralid.

Direct and Indirect Effects to Heritage Resources. The Direct and Indirect effects in Alternative 3 are the same as Alternative 2.

Direct and Indirect Effects to Reserved Treaty Rights. The effects in Alternative 3 are the same as Alternative 2.

3.10.3.2 Cumulative Effects

The affected area for an analysis of cumulative effects to heritage resources is the invasive plant sites. The affected area for cumulative effects to treaty rights and other tribal uses is the treatment analysis areas. The affected areas for specific resources such as salmon, wildlife and plants, are discussed in specific resource reports prepared for this project.

Cumulative Effects to Heritage Resources. None of the alternatives would adversely affect historic properties. Therefore, either of these alternatives, together with all previous projects, would not contribute to cumulative effects to heritage resources.

Cumulative Effects to Treaty Rights. Treaty reserved rights under the Treaty of Point Elliott are unaltered; therefore none of the alternatives would contribute to cumulative effects to treaty rights.

3.10.4 Consistencies with Regulations, Policies and Plans

This project is consistent with regulations, policies and plans associated with cultural resources.

3.11 Other Required Disclosures

3.11.1 Environmental Justice and Civil Rights

Low income and minority groups would see no change to their use of the MBS under this alternative. There currently are no disparate effects on these populations by forest management activities.

Executive Order 12898 directs federal agencies to identify and address the problem of adverse environmental effects by agency programs on minority and low income populations.

Employees or contractors for the MBS and/or one of the counties would likely implement herbicide treatments. County invasive plant control departments do not indicate that they employ any specific population group that could be disproportionately affected during invasive plant treatments. Regardless, licensed herbicide applicators are required to supervise work crews and proper personal protective equipment would be used. In addition, the MR/MM minimize potential effects on human health. These measures restrict rates, application methods, and extent of herbicide use so that even those who consume fish, meat or vegetation from the forest would not be adversely affected.

3.11.2 Irreversible and Irretrievable loss of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time, such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line right-of-way or road.

No irreversible or irretrievable uses of resources are associated with this invasive plant treatment project. This project restores native vegetation in areas where non-native plants have been introduced. Herbicide treatments in accordance with the alternatives would have relatively short-lived impacts, as effects on non-target species would be minimized by project management requirements, thus such effects would not be permanent.

3.11.3 Prime farmland, Rangeland and Forestland

No prime farmland, rangeland, or forestland exists in the project area; therefore, there would be no effects to these. Under the No-Action Alternative , continued spread and incidence of invasive plants on National Forest System lands could impact adjacent private lands which could be considered prime farmland or rangeland. Invasive plant treatments on lands adjacent to National Forest are discussed in Chapter 3.1.6.

Alternative 2 would be the most effective in reducing the potential of invasive plants to spread to private lands adjacent to the National Forest, because of reduced costs and more herbicide options available to treat invasive plants on the Forest (also see discussion in Chapter 3.2, Treatment Effectiveness).

3.11.4 Potential Conflicts with Plans or Policies of other Jurisdictions

No conflicts with existing plans have been noted for this project. Based on information received during scoping, none of the alternatives would conflict with existing plans or policies of other jurisdictions. The invasive plant treatments on neighboring lands are described in Chapter 3.1.6. These treatments would not necessarily follow the MR/MM for this project but would follow applicable laws and herbicide label requirements.

3.11.5 Permits and Licenses

The R6 2005 ROD Standard 15 requires that application of any herbicides to treat invasive plants will be performed or directly supervised by a state or federally licensed applicator.

A Clean Water Act (National Pollution Discharge Elimination System - NPDES) permit is required for herbicide use that may directly enter streams (streambanks, target vegetation hanging over water bodies, treatment sites generally within three feet from a water body). Treatments on small portions of riparian infestations (currently mapped or detected in the future) may meet the criteria; however, the target invasive species on the Malheur National Forest are not riparian dependent. The current mapping is not refined enough to determine whether a permit will ultimately be needed; however, NPDES Pesticide

General Permits would be obtained prior to implementing any treatments in which herbicide could be directly introduced into surface waters.

As discussed in Chapter 2 for the Implementation Planning Process that apply to all action alternatives, Form FS-2100-2 Pesticide Use Proposal, would be developed prior to herbicide treatment. In addition, as per FSH 2109.14.3, a pesticide use plan would be developed.

3.11.6 Non-significant Land and Resource Management Plan Amendment

A Forest Plan amendment would be implemented with this decision. The 2012 Planning Rule (36 CFR Part 219) allows plan amendments to be made using the procedures from the 1982 planning regulations during the 3-year transition period (36 CFR § 219.14 (b)(2)). Under the 1982 planning regulations, four factors are to be used when determining whether a proposed change to a Forest Plan is a significant amendment. The four factors are:

1. Actions that do not significantly alter the multiple-use goals and objectives for long-term land and resource management.

2. Adjustments of management area boundaries or management prescriptions resulting from further on-site analysis when the adjustments do not cause significant changes in the multiple-use goals and objectives for long-term land and resource management.

3. Minor changes in standards and guidelines.

4. Opportunities for additional projects or activities that will contribute to achievement of the management prescription.

This Forest Plan amendment enhances the agency's ability to address invasive species management objectives but does not alter multiple-use goals and objectives on the MBS NF to any extent. This Forest Plan amendment does not change any Forest Plan management area boundaries or management prescriptions on the MBS NF. Amending the standard will not change the multiple-use goals and objectives for long-term land and resource management of the MBS NF.

The Forest Plan amendment authorizes the use of a registered herbicide, aminopyralid. This herbicide is not currently listed among the ten herbicides approved by the Regional Forester in 2005 (R6 2005 ROD). The Risk Assessment for aminopyralid (SERA 2007) was completed subsequently and demonstrates that use of this herbicide will not pose new or significant risks compared to the ten already approved.

Aminopyralid is generally a lower risk herbicide and the proposed use will not pose additional risks to human health or the environment. U.S. EPA (2005) has concluded that the use of aminopyralid as a replacement for other herbicides will decrease risk to some non-target species:

> *Aminopyralid is a Reduced Risk herbicide that provides reliable control of a broad spectrum of difficult-to control noxious weeds and invasive plants on rangeland and pastures, rights-of-way, and wildlife habitat areas. Aminopyralid is particularly effective for the control of tropical soda apple, musk thistle, Canada thistle, spotted knapweed, diffuse knapweed, yellow starthistle and Russian knapweed. Aminopyralid has a favorable human health toxicity profile when compared to the registered alternatives for these use sites and will be applied at a lower rate. Its residual action should alleviate the need for repeat applications, resulting in a reduction in the amount of herbicides applied to the environment for the control of these weeds. Aminopyralid has been determined to be practically non-toxic to non-target animals at the registered application* rates, *compared to the alternatives, and is less likely to impact both terrestrial and aquatic plants.*

This Forest Plan amendment allows more effective and efficient treatment of invasive plants by adding aminopyralid to the list of approved herbicides on the MBS NF. Aminopyralid is an herbicide that is very effective for most of the invasive plant species found within the MBS NF. It was developed specifically for wildland use and is effective at low rates. It requires less restrictions than most of the other herbicides already approved in the Forest Plan (for instance it can be broadcast sprayed to the water's edge, which will improve treatment effectiveness and efficiency relative to other herbicides). Authorizing the use of aminopyralid will not foreclose on opportunities for additional projects or activities that will contribute to achievement of the management prescription. It will make those projects more effective in controlling invasive plants.

Based on these factors, adding aminopyralid to the list of herbicides approved for use treating invasive plants on the MBS would not be a significant amendment to the Forest Plan.

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Chapter 4. List of Preparers, Consultation and Coordination with Others (Tribes, Agencies)

4.1 List of Preparers

The following people were the primary authors of this FEIS. Many other Forest Service employees and others reviewed the document and provided input.

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4.2 Consultation with Regulatory Agencies

The Forest Service consulted with the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NOAA Fisheries, NMFS) regarding potential adverse effects on federally listed or proposed Threatened or Endangered Species. The process and results of consultation are discussed in Chapter 3.3 and 3.5. Consultation records are part of the Project Record.

4.3 Consultation with Tribal Governments

Government to government consultation is ongoing with 14 tribes including: the Lummi Nation, Muckleshoot Indian Tribe, Nisqually Indian Tribe, Nooksack Indian Tribe, Puyallup Tribe, Samish Tribe, Sauk-Suiattle Tribe, Snoqualmie Tribe, Stillaguamish Tribe, Suquamish Tribe, Swinomish Indian Tribal Community, the Tulalip Tribes, the Upper Skagit and the Yakama Tribe. Letters have been sent to all tribal chairs, and follow-up calls or meetings have occurred at the request of the tribes.

The Snoqualmie Tribe responded (4/16/2012) with a concern that herbicide treatment might occur near traditional harvest areas. No other replies were received from American Indian tribal governments regarding this project.

4.4 Consultation with Counties and Municipal Water Boards

The Forest Service consulted with County Weed Boards on invasive plant treatments proposed adjacent to and on county roads within the boundaries of the Forest. The Forest Service also contacted other federal and state agencies in regards to their known use of herbicides, including the National Park Service, the Bonneville Power Administration, Washington State Department of Transportation and Washington State Department of Natural Resources (see Chapter 3.1.6.2).

4.5 Consultation with Others/FEIS Distribution

Scoping has occurred on this project since 2010. The public has been apprised of project progress through the newspaper, direct mailings, Notices of Intent published in the Federal Register in 2012, the Forest Schedule of Proposed Actions, informal meetings and discussions, and other media. The full FEIS and Appendices are available electronically on the Forest website:
http://www.fs.fed.us/nepa/nepa_project_exp.php?project=34208

Agencies and members of the public expressing interest in the project received notice that the Final EIS is available on request and on the website noted above. Hard copies and CD-ROM versions of the documents were mailed directly to:

Individuals

William (Bill) Lider
Dick Artley
Eileen Maloney
Eric Olsen
Ben and Nancy Brodie
Dennis Clark
Brooke Thompson
Matt Bell

Organizations

Pilchuck Audubon
Middle Fork Outdoor Recreation Coalition
Northwest Coalition for Alternatives to Pesticides
Sierra Club

Agencies

Environmental Protection Agency
United States Department of Agriculture
Northwest Power Planning
Federal Energy Regulatory Commission
King County Noxious Weed Board
Seattle Major Watersheds

North Cascades National Park
U.S. Fish and Wildlife Service

Tribal Governments

Lummi Nation
Muckleshoot Indian Tribe
Nisqually Indian Tribe
Nooksack Indian Tribe
Puyallup Tribe
Samish Tribe
Sauk-Suiattle Tribe
Snoqualmie Tribe
Stillaguamish Tribe
Suquamish Tribe
Swinomish Indian Tribal Community
The Tulalip Tribes
The Upper Skagit
The Yakama Tribe

Chapter 5. Literature Cited, Glossary and Index

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5.2 Glossary

Active ingredient (a.i.) - In any pesticide product, the component (a chemical or biological substance) that kills or otherwise controls the target pests - Pesticides are regulated primarily on the basis of active ingredients. The remaining ingredients are called "inerts."

Activity center (northern spotted owl) - The core of an owl's territory and the focal point of protection measures. Most frequently located in or near the highest concentration of remaining suitable habitat.

Acute effect - An adverse effect on any living organism in which severe symptoms develop rapidly and often subside after the exposure stops.

Acute exposure - A single exposure or multiple brief exposures occurring within a short time (e.g., 24 hours or less in humans). The classification of multiple brief exposures as "acute" is dependent on the life span of the organism. (See also, chronic exposure and cumulative exposure.)

Acute toxicity - Any harmful effect produced in an organism through an acute exposure to one or more chemicals.

Additive effect - A situation in which the combined effects of exposure to two chemicals simultaneously is equal to the sum of the effect of exposure to each chemical given alone. The effect most commonly observed when an organism is exposed to two chemicals together is an additive effect.

Adaptive management - A continuing process of action-based planning, monitoring, researching, evaluating, and adjusting with the objective of improving implementation and achieving the goals of the standards and guidelines

Adjuvant(s) - Chemicals that are added to pesticide products to enhance the toxicity of the active ingredient or to make the active ingredient easier to handle or mix.

Adsorption - The tendency of one chemical to adhere to another material such as soil.

Affected Environment - Existing biological, physical, social, and economic conditions of an area subject to change, both directly and indirectly, as the result of a proposed human action.

Agent - Any substance, force, radiation, organism, or influence that affects the body. The effects may be beneficial or injurious.

Agency for Toxic Substances and Disease Registry (ATSDR) - Federal agency within the Public Health Service charged with carrying out the health-related analyses under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Superfund Amendments and Reauthorization Act (SARA).

Ambient - Usual or surrounding conditions.

Amphibian - Any of a class of cold-blooded vertebrates (including frogs, toads, or salamanders) that are intermediate in many characteristics between fishes and reptiles and having gilled aquatic larvae and air-breathing adults.

Anadromous (Fish) - Fish that spend their adult life in the sea but swim upriver to fresh water spawning grounds to reproduce.

Annual - A plant that endures for not more than a year. A plant which completes its entire life cycle from germinating seedling to seed production and death within a year.

Annual and Life of the Project Caps – The project caps are limitations on the acreage that may be treated annually and over the life of the project.

Bacteria - Microscopic living organisms that metabolize organic matter in soil, water, or other environmental media. Some bacteria can also cause human, animal and plant health problems.

Bankfull (elevation) – The elevation of water in a stream or river where it just fills the channel to the top of its banks and at a point where water begins to flow onto a floodplain.

Bear Management Unit (BMU) - The area assessed for carrying capacity of a sow grizzly bear and cub.

Best Management Practices (BMP) - A practice or combination of practices determined by a state or an agency to be the most effective and practical means (technological, economic, and institutional) of controlling point and non-point source pollutants at levels compatible with environmental quality.

Bioaccumulation - The increase in concentration of a substance in living organisms as they take in contaminated air, water, or food because the substance is very slowly metabolized or excreted (often concentrating in the body fat.)

Bioconcentration - The accumulation of a chemical in tissues of a fish or other organism to levels greater than in the surrounding water or environment.

Bioconcentration Factor (BCF) - The concentration of a compound in an aquatic organism divided by the concentration in the ambient water of the organism.

Biological control - The use of natural enemies, including invertebrate parasites and predators (usually insects, mites, and nematodes,) and plant pathogens to reduce populations of non-native, invasive plants.

Broadcast application - Herbicide treatment method generally used along roads; boom truck spray is directed at target species. Broadcast methods are used for larger infestations where spot treatments would not be effective.

Herbicide Use Buffer - A strip of land near a waterway or other environmentally sensitive area where a particular chemical and method of application is restricted, depending on the herbicide ingredient.

Candidate species - Those plant and animal species that, in the opinion of the Fish and Wildlife Service (FWS) or National Oceanic and Atmospheric Administration (NOAA) Fisheries, may qualify for listing as “endangered” or “threatened.” The FWS recognizes two categories of candidates. Category 1 candidates are taxa for which the FWS has on file sufficient information to support proposals for listing. Category 2 candidates are taxa for which information available to the FWS indicates that proposing to list is possibly appropriate, but for which sufficient data are not currently available to support proposed rules.

Carcinogen - A chemical capable of inducing cancer.

Chemical Control - The use of naturally derived or synthetic chemicals called herbicides to eliminate or control the growth of invasive plants.

Chronic exposure - Exposures that extend over the average lifetime or for a significant fraction of the lifetime of the species (for a rat, chronic exposure is typically about 2 years). Chronic exposure studies are used to evaluate the carcinogenic potential of chemicals and other long-term health effects. (See also, acute and cumulative exposure.)

Chronic toxicity - The ability of a substance or mixture of substances to cause harmful effects over an extended period, usually upon repeated or continuous exposure sometimes lasting for the entire life of the exposed organism

Code of Federal Regulations (CFR) - Document that codifies all rules of the executive departments and agencies of the federal government. It is divided into fifty volumes, known as titles. Title 40 of the CFR (referenced as 40 CFR) lists all environmental regulations, including regulations for EPA pesticide programs (40 CFR Parts 150-189).

Competitive Seeding – A treatment method that is intended to reduce the potential for invasive plants to become introduced or to reoccupy a site once target populations have been reduced. This method is often combined with other treatment methods.

Congressionally Designated Areas - Areas that require Congressional enactment for their establishment, such as National Parks, Wild and Scenic Rivers, National Recreation Areas, National Monuments, and Wilderness. Also referred to as Congressional Reserves. Includes similar areas established by Executive Order, such as National Monuments.

Connected Actions – An action that would occur at the same time and place, or would be required to occur, in order to implement a proposed action, and therefore would be analyzed in a single NEPA document.

Contaminants - For chemicals, impurities present in a commercial grade chemical. For biological agents, other agents that may be present in a commercial product.

Critical Habitat (for threatened or endangered species under the Endangered Species Act – (i) the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of section 4 of this Act, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of this Act, upon a determination by the Secretary that such areas are essential for the conservation of the species. The USFWS and the NMFS formally designate what is "critical habitat" for their respective species. Critical habitat includes the stream channels with a lateral extent defined by the ordinary high-water line [33 CFR 319.11]). Critical habitat: can include an area not currently occupied by the species, which is itself essential to the conservation of the species. As defined in the ESA "conservation" means any and all methods and procedures, and the use of those, needed to bring a species to recovery—the point at which the protections of the ESA are no longer needed.

Cultural control - The establishment or maintenance of competitive vegetation, use of fertilizing, mulching, prescribed burning, or grazing animals to control or eliminate invasive plants.

Cultural Items - From section 2 of the Native American Graves Protection and Repatriation Act (NAGPRA) (25 U.S.C. 3001 et seq.) which includes Associated Funerary Objects, Unassociated Funerary Objects, Sacred Objects, and Objects of Cultural Patrimony. The term "cultural items" does not include human remains.

Cumulative Effect - The impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions—regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time (40 CFR 1508.7).

Depressed Stock (fish) - A stock of fish whose production is below expected levels based on available habitat and natural variations in survival rates, but above the level where permanent damage to the stock is likely.

Disturbance - An effect of a planned human management activity, or unplanned native or exotic agent or event that changes the state of a landscape element, landscape pattern, or regional composition.

Dosage/Dose - (1) The actual quantity of a chemical administered to an organism or to which it is exposed. (2) The amount of a substance that reaches a specific tissue (e.g. the liver). (3) The amount of a substance available for interaction with metabolic processes after crossing the outer boundary of an organism.

Dose Response - Changes in toxicological responses of an individual (such as alterations in severity of symptoms) or populations (such as alterations in incidence) that are related to changes in the dose of any given substance.

Drift - The portion of a sprayed chemical that is moved by wind off of a target site.

Early Detection and Rapid Response (EDRR) – Treatment of invasive plants over the life of the project according to the implementation planning process.

Endangered Species - Any species listed in the Federal Register as being in danger of extinction throughout all, or a significant portion, of its range.

Endangered Species Act (ESA) - A law passed in 1973 to conserve species of wildlife and plants, determined by the Director of the U.S. Fish and Wildlife Service or the NOAA Fisheries to be endangered or threatened with extinction in all or a significant portion of its range. Among other measures, ESA requires all federal agencies to conserve these species and consult with the Fish and Wildlife Service or NOAA Fisheries on federal actions that may affect these species or their designated critical habitat.

Endemic - A species or other taxonomic group that is restricted to a particular geographic region due to factors such as isolation or response to soil or climatic conditions. (Compare to “Indigenous” and “Native.”)

Environmental justice - Executive Order 12898 of February 11, 1994 requires federal agencies, to the greatest extent practicable and permitted by law, to make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions, the District of Columbia, the Commonwealth of Puerto Rico, and the commonwealth of the Mariana Islands.

Essential Fish Habitat - Waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.

Exotic – Non-native species; introduced from elsewhere, but not completely naturalized. (See also alien and introduced species.)

Extirpated – An organism that is eliminated from a local area.

Fish-Bearing Streams - Any stream containing any species of fish for any period of time.

Federal Insecticide and Rodenticide Act (FIFRA) Pesticide Ingredient - An ingredient of a pesticide that must be registered with EPA under the Federal Insecticide, Fungicide, and Rodenticide Act. Products making pesticide claims must submit required information to EPA to register under FIFRA and may be subject to labeling and use requirements.

Fertilization - Treatment method involving adding of nutrients that could improve the success of desirable species; may be limited, depending on species/soil characteristics.

First-choice Herbicides – First-choice herbicides are those that would be used during the first year of treatment of a given primary target species. It is likely be most effective, given the options associated with a given action alternative. First-choice herbicides are often used in combination with non-herbicide methods.

Flora - Plant life, especially all the plants found in a particular country, region, or time regarded as a group. Also, a systematic set of descriptions of all the plants of a particular place or time.

Forage - Food for animals. In this document, term applies to both availability of plant material for wildlife and domestic livestock.

Forest Service Sensitive Species - For Region 6 of the Forest Service, those plant and animal species identified by the Regional Forester for which population viability is a concern, as evidenced by significant current or predicted downward trends in population numbers or density and habitat capability that would reduce a species' existing distribution (FSM 2670.5).

Formulation - A commercial preparation of a chemical including any inerts and/or contaminants.

Fragmentation - The degree to which the landscape is broken into distinct patch types.

Fungi - Molds, mildews, yeasts, mushrooms, and puffballs, a group of organisms that lack chlorophyll and therefore are not photosynthetic. They are usually non-mobile, filamentous, and multi-cellular.

Geographical Information System (GIS) – Maps and data showing location and attributes for natural resources found within a project area.

Groundwater - The supply of fresh water found beneath the Earth's surface, usually in aquifers, which often supply wells and springs.

Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) - A model that displays herbicide concentrations in streams under a variety of soil, climate, and vegetative conditions.

Habitat - The place where a population (e.g., human, animal, plant, microorganism) lives and its surroundings, both living and non-living.

Half-life - The time required for the concentration of the chemical to decrease by one-half.

Hand/Selective application - Herbicide treatment of individual plants through wicking, wiping, injecting stems, etc., with low likelihood of drift or delivery of herbicides away from treatment sites. This method ensures no herbicide directly contacts soil.

Hand-pulling/Grubbing - Treatment method which is labor-intensive but effective on single plants or on small, low-density infestations.

Hazard Quotient (HQ) - The ratio of the estimated level of exposure to a substance from a specific pesticide application to the RfD for that substance, or to some other index of acceptable exposure or toxicity. A HQ less than or equal to 1 is presumed to indicate an acceptably low level of risk for that specific application.

Hazard identification - The process of identifying the array of potential effects that an agent may induce in an exposed of humans or other organisms.

Healthy Stock - A stock of fish experiencing production levels consistent with its available habitat and within the natural variations in survival for the stock.

Herbaceous - A plant that does not develop persistent woody tissue above the ground (annual, biennial, or perennial.) Herbaceous vegetation includes grasses and grass-like vegetation, and broadleaved forbs.

Herbicide - A chemical preparation designed to kill plants, especially weeds, or to otherwise inhibit their growth. May or may not include an additive (adjuvant) such as a surfactant.

Herbicide Application Rate – The amount of herbicide active ingredient that would be used on a treated acre. The maximum rate is the amount allowed by an herbicide label. Typical rate is the average rate used by the Forest Service for invasive plant treatment projects. Lowest rate (or lowest effective rate) is the least amount of herbicide that could be used to reach treatment objectives.

Herbicide Treatment – Any use of herbicide to meet treatment objectives. Herbicide treatments are part of the integrated weed management toolbox. Herbicide treatment may be combined with non-herbicide treatments to meet treatment objectives.

Herbicide Use Buffer – An area adjacent to a stream or other water body where herbicide ingredient or application methods are restricted.

Hibernacula - Sites where hibernation occurs.

Human influence zone -Areas of human activity (recreation sites, roads, trails, buildings, mines, hydropower operations, etc.) buffered by one-third mile around trails and one-half mile around roads and other sites.

Ordinary high water line – see bankfull.

Indian Tribe - Any American Indian or Alaska Native tribe, band, nation, pueblo, community, rancheria, colony, or group meeting the provisions of the Code of Federal Regulations Title 25, Section 83.7 (25 FR 83.7), or those recognized in statutes or treaties with the United States.

Indigenous Species - An indigenous species is any which were or are native or inherent to an area. (See also, native.)

Inert Ingredient - Anything other than the active ingredient in a pesticide product; not having pesticide properties.

Infested area or site - A contiguous area of land occupied by, in this case, invasive plant species. An infested area of land is defined by drawing a line around the actual perimeter of the infestation as defined by the canopy cover of the plants, excluding areas not infested. Generally, the smallest area of infestation mapped will be 1/10th (0.10) of an acre or 0.04 hectares.

Integrated Weed Management (IWM) - An interdisciplinary weed management approach for selecting methods for preventing, containing, and controlling noxious weeds in coordination with other resource management activities to achieve optimum management goals and objectives.

Interdisciplinary Team (IDT) - A group of individuals with varying areas of specialty assembled to solve a problem or perform a task. The team is assembled out of recognition that no one scientific discipline is sufficiently broad enough to adequately analyze the problem and propose action.

Introduced species - An alien or exotic species that has been intentionally or unintentionally released into an area as a result of human activity. (See also exotic, invasive, and noxious.)

Introduction - “The intentional or unintentional escape, release, dissemination, or placement of a species into an ecosystem as a result of human activity” (Executive Order 13122, 2/3/99).

Invasive plant - An alien plant species whose introduction does or is likely to cause economic or environmental harm or harm to human health (Executive Order 13122, 2/3/99) (See also exotic and introduced species)

Irreversible effect - Effect characterized by the inability of the body to partially or fully repair injury caused by a toxic agent.

LC50 (Lethal Concentration 50) - A calculated concentration of a chemical in air or water to which exposure for a specific length of time is expected to cause death in 50 percent of a defined experimental animal population.

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. The observation period is typically 14 days.

Label - All printed material attached to, or part of, the pesticide container.

Land allocation – An management area designated in a Land and Resource Management Plan associated with certain desired conditions, objectives and standards.

Landscape - An area composed of interacting ecosystems that are repeated because of geology, land form, soils, climate, biota, and human influences throughout the area. Landscapes are generally of a size, shape, and pattern which is determined by interacting ecosystems.

Landscape Character - Particular attributes, qualities, and traits of a landscape that give it an image and make it identifiable or unique.

Landscape Setting - The context and environment in which a landscape is set; a landscape backdrop. It is the combination of land use, landform, and vegetation patterns that distinguish an area in appearance and character from other areas.

Large woody debris - Pieces of wood larger than 10 feet long and 6 inches in diameter.

Late-successional forest - Late-successional forests are those forest seral stages that include mature and old-growth age classes. (ROD USDA-USDI, Standards and Guidelines 1994, B-1)

Leaching - The process by which chemicals on or in soil or other porous media are dissolved and carried away by water, or are moved into a lower layer of soil.

Level of Concern (LOC) - The concentration in media or some other estimate of exposure above which there may be effects.

Lichens - Complex thallophytic plants comprised of an alga and a fungus growing in symbiotic association on a solid surface (such as a rock.)

Lowest-Observed-Adverse-Effect Level (LOAEL) - The lowest dose of a chemical in a study, or group of studies, that produces statistically or biologically significant increases in frequency or severity of adverse effects between the exposed and control populations.

Manual Control - The use of any non-mechanized approach to control or eliminate invasive plants (i.e. hand-pulling, grubbing)

Material Safety Data Sheet (MSDS) - A compilation of information required under the OSHA Communication Standard on the identity of hazardous chemicals, health and physical hazards, exposure limits, and precautions.

Mechanical Control - The use of any mechanized approach to control or eliminate invasive plants (i.e. mowing, weed whipping).

Microorganisms - A generic term for all organisms consisting only of a single cell, such as bacteria, viruses, protozoa and some fungi.

Minimum tool - Use of a weed treatment alternative that would accomplish management objectives and have the least impact on resources

Modification - A visual quality objective meaning human activities may dominate the characteristic landscape but must, at the same time, utilize naturally established form, line, color, and texture. It should appear as a natural occurrence when viewed in foreground or middleground.

Mollusks - Invertebrate animals (such as slugs, snails, clams, or squids) that have a soft, un-segmented body, usually enclosed in a calcareous shell; representatives found on National Forest System land include snails, slugs, and clams.

Monitoring - A process of collecting information to evaluate if objectives and anticipated or assumed results of a management plan are being realized or if implementation is proceeding as planned.

Most Ambitious Conceivable Treatment Level – The most ambitious treatment scenario would treat all known infestations during the first year of implementation and then retreated until management objectives are met. It includes treatments, re-treatments over a series of years, and passive or active restoratino. It is an assumption that allows for a consistent analysis comparing alterantives given that Forest Service ability funding over the life ofthe project is unknown.

Mowing - Invasive plant treatment method which is limited to level/gently-sloping smooth-surface terrain. Treatment timing is critical, and must be conducted for several consecutive years.

National Environmental Policy Act (NEPA) - An Act passed in 1969 to declare a national policy that encourages productive and enjoyable harmony between humankind and the environment, promotes efforts that prevent or eliminate damage to the environment and biosphere, stimulates the health and welfare of humanity, enriches the understanding of the ecological systems and natural resources important to the nation, and establishes a Council on Environmental Quality.

National Forest Management Act (NFMA) - A law passed in 1976 as an amendment to the Forest and Rangeland Renewable Resources Planning Act, requiring preparation of Forest Plans and the preparation of regulations to guide that development.

National Marine Fisheries Service (NMFS) - The federal agency that is the listing authority for marine mammals and anadromous fish under the ESA.

National Pollutant Discharge Elimination System (NPDES) - As authorized by the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Point sources are discrete conveyances such as pipes or man-made ditches. Individual homes that are connected to a municipal system, use a septic system, or do not have a surface discharge do not need an NPDES permit; however, industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters.

National Wilderness Preservation System (NWPS) - The Wilderness Act of 1964 established the national Wilderness Preservation System to ensure that certain federally owned areas in the United States would be preserved and protected in their natural condition. The Act defines a wilderness area, in part, as an area which generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable. Areas included in the system are administered for the use and enjoyment of the American people in such manner as to leave them unimpaired for future use and enjoyment as wilderness.

Native species - With respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem (Executive Order 13122, 2/3/99).

Neotropical migrants birds - Birds that migrate from North America to regions south of the Tropic of Cancer (latitude 23 1/2 degrees north) to winter.

Non-target species - Any plant or animal that is not the intended organism to be controlled by a pesticide treatment.

No-Observed-Adverse-Effect level (NOAEL) - Exposure level at which there are no statistically or biological significant differences in the frequency or severity of any adverse effect in the exposed or control populations

No-Observed-Effect-Level (NOEL) - Exposure level at which there are no statistically or biological significant differences in the frequency or severity of any effect in the exposed or control populations.

Noxious weed - "Any living stage (including but not limited to, seeds and reproductive parts) of any parasitic or other plant of a kind, or subdivision of a kind, which is of foreign origin, is new to or not widely prevalent in the United States, and can directly or indirectly injure crops, other useful plants, livestock, or poultry or other interests of agriculture, including irrigation, or navigation or the fish and wildlife resources of the United States or the public health" (Public Law 93-629, January 3, 1975, Federal Noxious Weed Act of 1974).

Omnivore - An animal that feeds on both plants and animals.

Outstandingly Remarkable Value (ORV) - A characteristic of rivers or sections of rivers in the national Wild and Scenic River System. In order for a river to be included in the system, it must possess at least one "outstandingly remarkable" value, such as scenic, recreational, geologic, fish, wildlife, historic, cultural, or other similar features. Outstandingly Remarkable Values are values or opportunities in a river corridor which are directly related to the river and which are rare, unique, or exemplary from a regional or national perspective.

Partial Retention - A visual quality objective which in general means human activities may be evident but must remain subordinate to the characteristic landscape.

Pathogen - A living organism, typically a bacteria or virus that causes adverse effects in another organism.

Percolation - Downward flow or filtering of water through pores or spaces in rock or soil.

Perennial Plant- A plant species having a life span of more than 2 years.

Persistence - Refers to the length of time a compound, once introduced into the environment, stays there.

Personal Protective Equipment (PPE) - Clothing and equipment worn by herbicide mixers, loaders and applicators and re-entry workers worn to reduce their exposure to potentially hazardous chemicals and other pollutants.

Pest - An insect, rodent, nematode, fungus, weed or other form of terrestrial or aquatic plant or animal life that is classified as undesirable because it is injurious to health or the environment.

Pesticide - Any substance used for controlling, preventing, destroying, repelling, or mitigating any pest. Includes fungicides, herbicides, fumigants, insecticides, nematicides, rodenticides, desiccants, defoliants, plant growth regulators, etc.

pH - The negative log of the hydrogen ion concentration. A high pH (greater than 7) is alkaline or basic and a low pH (less than 7) is acidic.

Population - A group of individuals of the same species in an area.

Project “Caps” – Limitations on the acreage that may be treated annually and through the life of the project.

Proposed species - Any plant or animal species that is proposed by the Fish and Wildlife Service or NOAA Fisheries in a Federal Register notice to be listed as threatened or endangered.

Recreational Rivers - A classification within the national Wild and Scenic River System. Recreational rivers are those rivers, or sections of rivers, that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

Redd –A spawning nest made by a fish, especially a salmon or trout.

Reference Dose (RfD) - The RfD is a numerical estimate of a daily exposure to the human population, including sensitive subgroups such as children, that is not likely to cause harmful effects during a lifetime. RfDs are generally used for health effects that are thought to have a threshold or minimum dose for producing effects.

Registered Pesticides - Pesticide products which have been approved for the uses listed on the label.

Restoration - Ecological restoration is the process of assisting the recovery and management of ecological integrity. Ecological integrity includes a critical range of variability in biodiversity, ecological processes and structures, regional and historical context, and sustainable cultural practices. Restoration may be passive (passing of time to allow for site recovery) or active (in this project, active restoration includes seeding, mulching and planting after invasive plants are removed).

Revegetation - The re-establishment of plants on a site - The term does not imply native or non-native; does not imply that the site can ever support any other types of plants or species and is not at all concerned with how the site 'functions' as an ecosystem.

Riparian Area (or zone) - Those terrestrial areas where the vegetation complex and microclimate conditions are products of the combined presence and influence of perennial and/or intermittent water, associated high water tables, and soils that exhibit some wetness characteristics. Normally used to refer to the zone within which plants grow rooted in the water table of these rivers, streams, lakes, ponds, reservoirs, springs, marshes, seeps, bogs, and wet meadows.

Riparian Reserve - Areas along live and intermittent streams, wetlands, ponds, lakes, and unstable and potentially unstable areas where riparian-dependent resources receive primary emphasis. Riparian Reserves are important to the terrestrial ecosystem as well, serving as dispersal habitat for certain terrestrial species.

Risk - The chance of an adverse or undesirable effect, often measured as a percentage.

Risk Assessment - The qualitative and quantitative evaluation performed in an effort to estimate the risk posed to human health and/or the environment by the presence or potential presence and/or use of specific chemical or biological agents.

Scenic Rivers - A classification within the national Wild and Scenic River System. Scenic rivers are those rivers, or sections of rivers, that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.

Security habitat - Habitat defined as 0.25 mile from open road or outside of human influence zones for mountain goats, 0.3 mile for grizzly bear core and wolf security habitat.

Sensitive Species – Sensitive species are identified by a Regional Forester for which population viability is a concern, as evidenced by significant current or predicted downward trends in population numbers or density and habitat capability that would reduce a species' existing distribution (FSM 2670.5). Management of sensitive species "must not result in a loss of species viability or create significant trends toward federal listing" (FSM 2670.32).

Seral -Of or pertaining to the series of stages in the process of ecological succession.

Spawn - to deposit fish eggs or sperm directly into the water.

Species of Conservation Concern (aka Concern Species) - Threatened, endangered and proposed species; Regional Forester's Sensitive species, management indicator species, and other identified native species of concern to biologists on the MBS.

Species - "A group of organisms, all of which have a high degree of physical and genetic similarity, generally interbreed only among themselves, and show persistent differences from members of allied groups of organisms." (Executive Order 13122, 2/3/99).

Spot application - Herbicide treatment involving use of a backpack sprayer or other means. Application is aimed at specific target species, with methods of prevention (such as barriers) to control damage to non-target species.

Standards and guidelines - The rules and limits governing actions, as well as the principles specifying the environmental conditions or levels to be achieved and maintained.

Stock —The fish spawning in a particular lake or stream(s) at a particular season, which fish to a substantial degree do not interbreed with any group spawning in a different place, or in the same place at a different season.

Suitable habitat - Habitat in which an animal or plant can meet all or some of its life history requirements.

Surface water - All water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors which are directly influenced by surface water.

Surfactant - A surface active agent; usually an organic compound whose molecules contain a hydrophilic group at one end and a lipophilic group at the other. Promotes solubility of a chemical, or lathering, or reduces surface tension of a solution.

Synergistic effect - Situation in which the combined effects of exposure to two chemicals simultaneously is much greater than the sum of the effect of exposure to each chemical given alone.

Take - "The term 'take' means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (Title 16, Chapter 35, Section 1532, Endangered Species Act of 1973).

Threatened species - Plant or animal species likely to become endangered throughout all, or a significant portion of, its range within the foreseeable future. A plant or animal identified and defined in accordance with the 1973 Endangered Species Act and published in the Federal Register.

Threshold of Concern - The maximum dose or concentration level of a chemical or biological agent that will not cause an effect in the organism.

Toxicity - The inherent ability of an agent to affect living organisms adversely. Toxicity is the degree to which a substance or mixture of substances can harm humans or animals.

Toxicology - The study of the nature, effects, and detection of poisons in living organisms. Also, substances that are otherwise harmless but prove toxic under particular conditions. The basic assumption of toxicology is that there is a relationship among the dose (amount), the concentration at the affected site, and the resulting effects.

Treatment Objectives: Treatment objectives reflect the desired outcome depending on the extent, distribution and priority for treating a given invasive plant species.

- Eradicate: Eliminate an invasive plant species from a site. This objective generally applies to species that are difficult to control and cover small areas. Some occurrences may be on roadsides (Russian knapweed, squarrose knapweed) and others may occur in intact native vegetation (yellow starthistle, small occurrences of thistles or knapweed, new invaders). This is generally our first priority for treatment.
- Control: Reduce the size of the infestation over time; some level of infestation may be acceptable. This objective applies to most of the target species (houndstongue, leafy spurge, perennial pepperweed, sulfur cinquefoil, whitetop) and large infestations of thistles and knapweeds. This is generally our second priority for treatment.

§ Contain: Prevent the spread of the weed beyond the perimeter of patches or infestation areas mapped from current inventories. This objective applies to target species such as common St. Johnswort. This is generally our third priority for treatment.

§ Suppress: Prevent seed production throughout the target patch and reduce the area coverage. Prevent the invasive species from dominating the vegetation of the area; low levels may be acceptable. This objective applies to target species such as toadflax that would be treated mainly with biocontrol agents. This is generally our fourth priority for treatment.

§ Tolerate: Accept the continued presence of established infestations and the probable spread to ecological limits for certain species. This category is for species that are so widespread and abundant that other objectives would be extremely difficult to meet. This category includes species such as cheatgrass, medusahead, North Africa grass, dandelion, mullein, and bulbous bluegrass. These invasive plants have low priority for treatment and would likely only be treated if they happen to be near one of the primary target species.

Tribal and Treaty Rights - Native American treaty and other rights or interests recognized by treaties, statutes, laws, executive orders, or other government action, or federal court decisions.

Unknown Stock – A description applied to stocks where there is insufficient information to identify stock origin or stock status with confidence.

U.S. Fish and Wildlife Service (United States Department of the Interior Fish and Wildlife Service, USDI FWS, USFWS) - The federal agency that is the listing authority for species other than marine mammals and anadromous fish under the Endangered Species Act.

USDA Forest Service (United States Department of Agriculture Forest Service, FS or USFS) - The federal agency responsible for management of the Nation's National Forest System lands

Viability - Ability of a wildlife or plant population to maintain sufficient size to persist over time in spite of normal fluctuations in numbers, usually expressed as a probability of maintaining a specific population for a specified period.

Viable Population - A wildlife or plant population that contains an adequate number of reproductive individuals appropriately distributed on the planning area to ensure the long-term existence of the species.

Viewshed - Total visible area from a single observer position, or the total visible area from multiple observer position. Viewsheds are accumulated seen-areas from highways, trails, campgrounds, towns, cities, or other viewer locations. Examples are corridor, feature, or basin viewsheds.

Visual Quality Objective - A desired level of excellence based on physical and sociological characteristics of an area. Refers to degree of acceptable alteration of the characteristic landscape.

Waterline – the edge of surface water at the current time.

Well-distributed population- Distribution sufficient to permit normal biological function and species interactions, considering life history characteristics of the species and the habitats for which it is specifically adapted.

Wetland - An area that is regularly saturated by surface or ground water and subsequently is characterized by a prevalence of vegetation that is adapted for life in saturated soil conditions. Examples include swamps, bogs, fens, marshes, and estuaries.

Wild and Scenic River System - The Wild and Scenic Rivers Act of 1968 established a system of selected rivers in the United States, which possess outstandingly remarkable values, to be preserved in free-flowing condition. Within the national system of rivers, three classifications define the general character of designated rivers: Wild, Scenic, and Recreational. Classifications reflect levels of development and natural conditions along a stretch of river. Classifications are used to help develop management goals for the river.

Wilderness - Areas designated by Congressional action under the 1964 Wilderness Act. Wilderness is defined as undeveloped federal land retaining its primeval character and influence without permanent improvements or human habitation. Wilderness areas are protected and managed to preserve their natural conditions, which generally appear to have been affected primarily by the forces of nature with the imprint of human activity substantially unnoticeable; have outstanding opportunities for solitude or for a primitive and confined type of recreation; include at least 5,000 acres, or are of sufficient size to make practical their preservation, enjoyment, and use in an unimpaired condition; and may contain features of scientific, educational, scenic, or historical value as well as ecological and geologic interest.

Wild Rivers - A classification within the national Wild and Scenic River System. Wild rivers are those rivers, or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted.

Wolf rendezvous sites - Temporary resting sites used for several days at a time by a wolf pack during summer months while the pups are developing.

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Appendix A - Treatment Analysis Area Atlas Example

Appendix A provides information about Treatment Analysis Area 11 to demonstrate the type of information available for each Treatment Analysis Area. Maps and information about all of the Treatment Analysis Areas on the MBS are available online at: http://www.fs.fed.us/nepa/nepa_project_exp.php?project=34208.

For each treatment analysis area, total infested acreage within the Treatment Analysis Area (TAA), a description of the area, and the 5th field watershed within which the TAA resides are identified. Infested acreage is the sum of acreage for each species (please note that about 20 percent of the sites overlap within the project area and these overlaps are not accounted for in the acreage total).

For each mapped invasive plant (NRIS) site, the species, name of the site, acreage, treatment objective (contain, control, or eradicate), and first year/first choice treatment to meet the objective is designated. The first year/first choice treatment method in this example and in the full TAA atlas is based on the Proposed Action.

Maps have been developed to show each NRIS site within a Treatment Analysis Area.

Treatment Analysis Area: 11

Treatment Analysis Area Name: I-90 Corridor in King County

Infested acres: 114.8

Description: Upper South Fork of Snoqualmie River watershed from about McClellan Butte east to the county line. Although the polygon encompasses I-90 is, the treatment sites do not include the I-90 road prism itself, which is the responsibility of WSDOT and the Federal Highway Department.

5th Field Watershed: South Fork Snoqualmie River 171100103

Table A- 1. Invasive Plant Species Mapped Within Treatment Analysis Area 11

Species	NRIS ID	Site Name	2012 approximate Infested Acres	Objective	First Year/First Choice Treatment Method for the Proposed Action (in parenthesis if method is already approved)
orange hawkweed	6050500016	Alpental roads 9040 & PCT lots	2.4	eradicate	aminopyralid
spotted knapweed	6050500023	Granite Mtn. trailhead	0.3	eradicate	aminopyralid
orange hawkweed	6050500024	Alpental ski area	0.2	control	aminopyralid
Bohemian knotweed	6050500060	Road 9031 milepost 2.8	0.8	eradicate	(imazapyr/glyphosate-aquatic)
absinth wormwood	6050500062	Denny Creek Road	2.2	control	aminopyralid
orange hawkweed	6050500071	Denny Creek Road	13.6	control	aminopyralid
meadow hawkweed	6050500072	Denny Creek Road	13.6	control	aminopyralid
common hawkweed	6050500073	Denny Creek Road	3.3	control	aminopyralid
yellow archangel	05-AR-073	Denny Ck Rec Res #4	0.1	eradicate	(glyphosate-aquatic)

Species	NRIS ID	Site Name	2012 approximate Infested Acres	Objective	First Year/First Choice Treatment Method for the Proposed Action (in parenthesis if method is already approved)
spotted knapweed	05-DL-001	Asahel Curtis trailhead	0.3	eradicate	aminopyralid
Bohemian knotweed	05-KB-049	Mason Ck; Menke acquisition(a.k.a. I-90 Exit42)	0.7	eradicate	(imazapyr/ glyphosate-aquatic)
Scotch broom	05-KM-007	Bandera/Rd 5510&110 spur	4.0	contain	aminopyralid
Scotch broom	05-KM-008	Bandera; Rd 5510-160	5.0	contain	broadcast-aminopyralid
Scotch broom	05-KM-077	Road 9030	3.0	control	broadcast-aminopyralid
dalmatian toadflax	05-KM-078	RR tracks @ Humpback Ck	8.7	control	chlorsulfuron
orange hawkweed	05-KM-079	"I-90 below underpass, Wbound lanes	0.8	control	aminopyralid
tansy ragwort	05-KW-002	Pratt R. stockpile/ borrow pit	0.2	eradicate	aminopyralid
herb Robert	05-KW-003	Pratt R. stockpile/ borrow pit	0.2	eradicate	glyphosate
sulphur cinquefoil	05-KW-004	Pratt R. stockpile/ borrow pit	0.2	eradicate	metsulfuron methyl
Scotch broom	05-KW-005	Pratt R. stockpile/ borrow pit	0.2	eradicate	(hand-pull)
orange hawkweed	05-KW-006	Pratt R. stockpile/ borrow pit	0.2	eradicate	aminopyralid
spotted knapweed	05-KW-007	Pratt R. stockpile/ borrow pit	0.2	eradicate	aminopyralid
Scotch broom	05-KW-013	John Wayne Trail	0.6	control	(hand-pull)
dalmatian toadflax	05-KW-014	John Wayne Trail	0.6	control	chlorsulfuron
spotted knapweed	05-KW-015	John Wayne Trail	0.1	eradicate	aminopyralid
sulphur cinquefoil	05-KW-022	McClellan Butte Trailhead	0.1	eradicate	metsulfuron methyl
herb Robert	05-KW-023	Tinkham Campground	9.6	eradicate	(hand-pull)
tansy ragwort	05-KW-024	S Fk Snoqualmie Gravel Bars	1.9	contain	aminopyralid
spotted knapweed	05-KW-025	S Fk Snoqualmie Gravel Bars	1.9	control	aminopyralid
spotted knapweed	05-KW-026	Snow Lake parking lot	7.2	eradicate	aminopyralid
orange hawkweed	05-KW-027	Snow Lake Trailhead	0.1	eradicate	aminopyralid
tansy ragwort	05-KW-037	Rd 5510-310	0.1	contain	aminopyralid
woolly hedgenettle	05-KW-038	Rd 5510-410, sec 21	0.1	eradicate	glyphosate

Species	NRIS ID	Site Name	2012 approximate Infested Acres	Objective	First Year/First Choice Treatment Method for the Proposed Action (in parenthesis if method is already approved)
tansy ragwort	05-KW-039	Rd 5510 Hansen Creek	0.1	contain	(hand-pull)
spotted knapweed	05-KW-040	Rd 5510-410, sec 28	0.1	eradicate	(hand-pull)
Bohemian knotweed	05-LP-021	Mason Lake Rd	0.1	eradicate	(imazapyr/glyphosate-aquatic)
dalmatian toadflax	05-LP-083	I-90 m.p. 38 to MBS boundary	13.1	control	chlorsulfuron
meadow knapweed	05-TF-001	Road 5800	0.1	eradicate	aminopyralid
tansy ragwort	05-TF-002	Road 5800	0.1	contain	(hand-pull)
spotted knapweed	05-TF-003	Road 5800 East (revisit)	13.6	control	aminopyralid
orange hawkweed	05-TF-004	Road 5800/9040 junction	0.1	control	aminopyralid
herb Robert	05-TF-005	McClellan Butte TH	1.9	eradicate	(glyphosate-aquatic)
spotted knapweed	05-TF-006	McClellan Butte TH	1.9	eradicate	(hand-pull)
common hawkweed	05-TF-015	Road 9020	0.1	control	aminopyralid
Scotch broom	05-TF-016	Road 9020, milepost 7.6	0.1	control	aminopyralid
yellow archangel	05-TF-023	Denny Ck Rec Res #4	0.1	eradicate	(glyphosate-aquatic)
Bohemian knotweed	05-TF-040	9030 Rd	0.1	eradicate	imazapyr/glyphosate
dalmatian toadflax	05-TF-076	Pratt R. stockpile/ borrow pit	0.2	eradicate	chlorsulfuron
orange hawkweed	05-VW-074	Commonwealth Campground	0.6	eradicate	aminopyralid

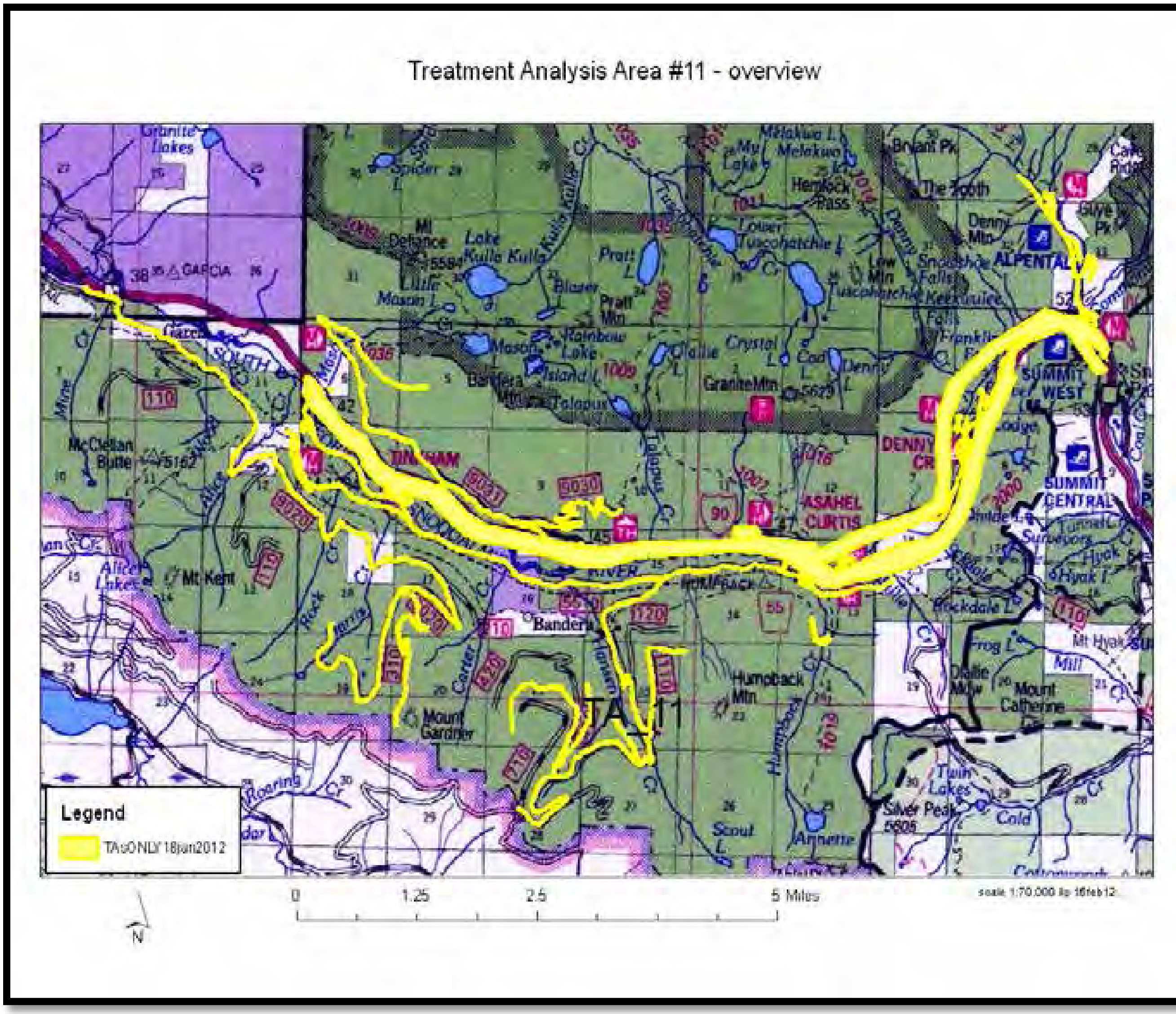

Figure A -1. Treatment Analysis Area 11 Overview Map

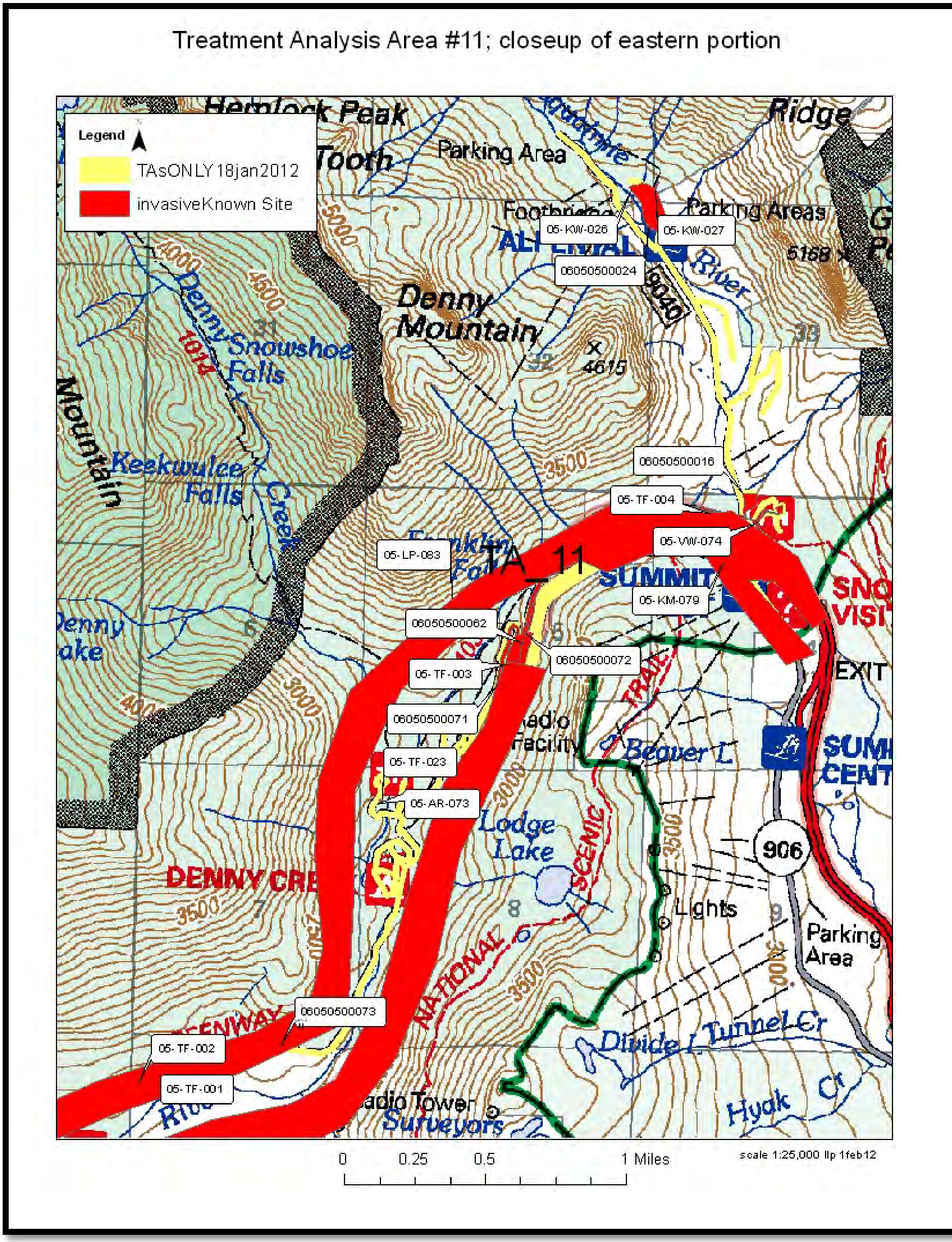

Figure A -2. Map of Treatment Analysis Area 11 Eastern Portion

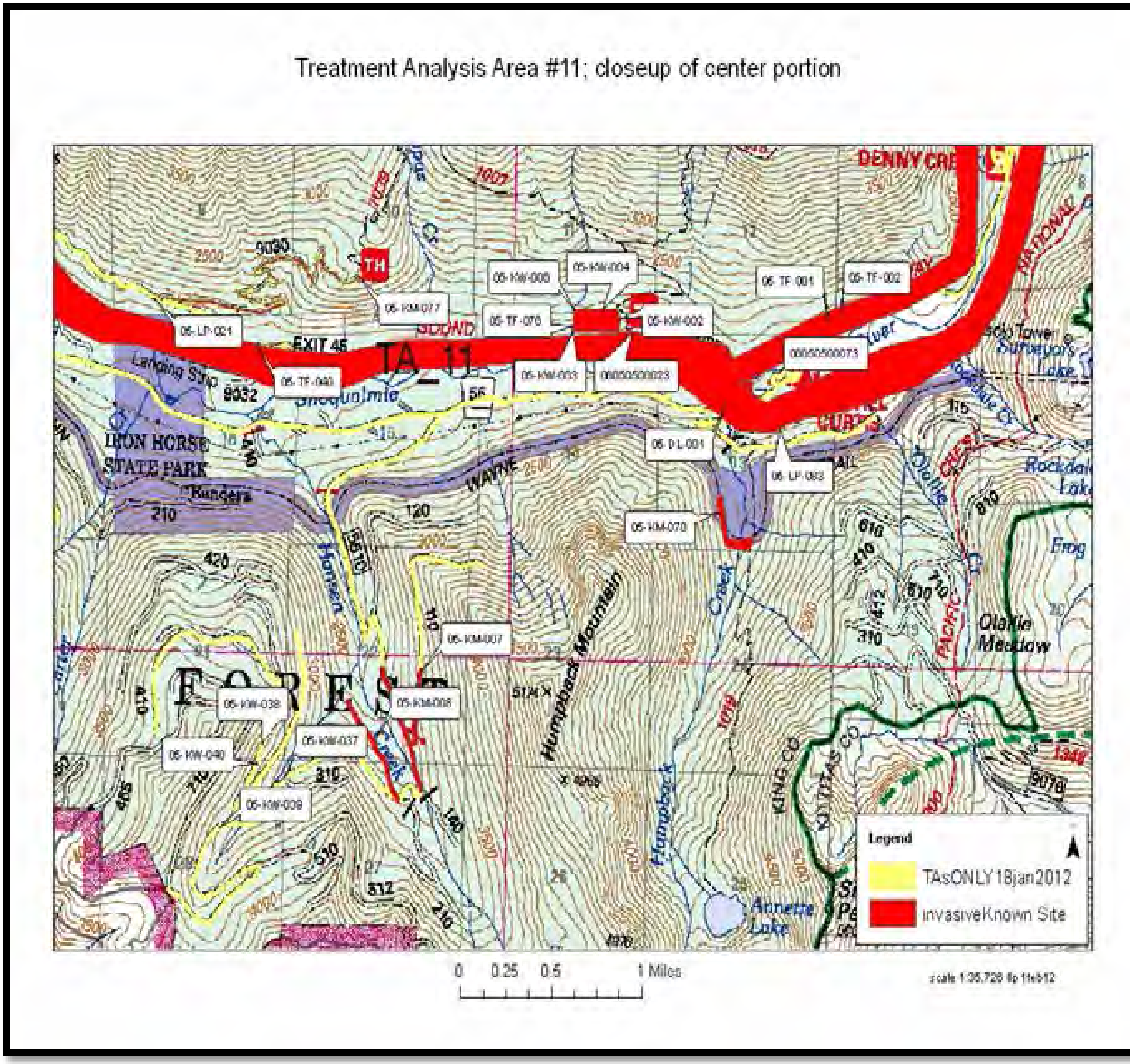

Figure A -3. Map of Treatment Analysis Area 11 Central Portion

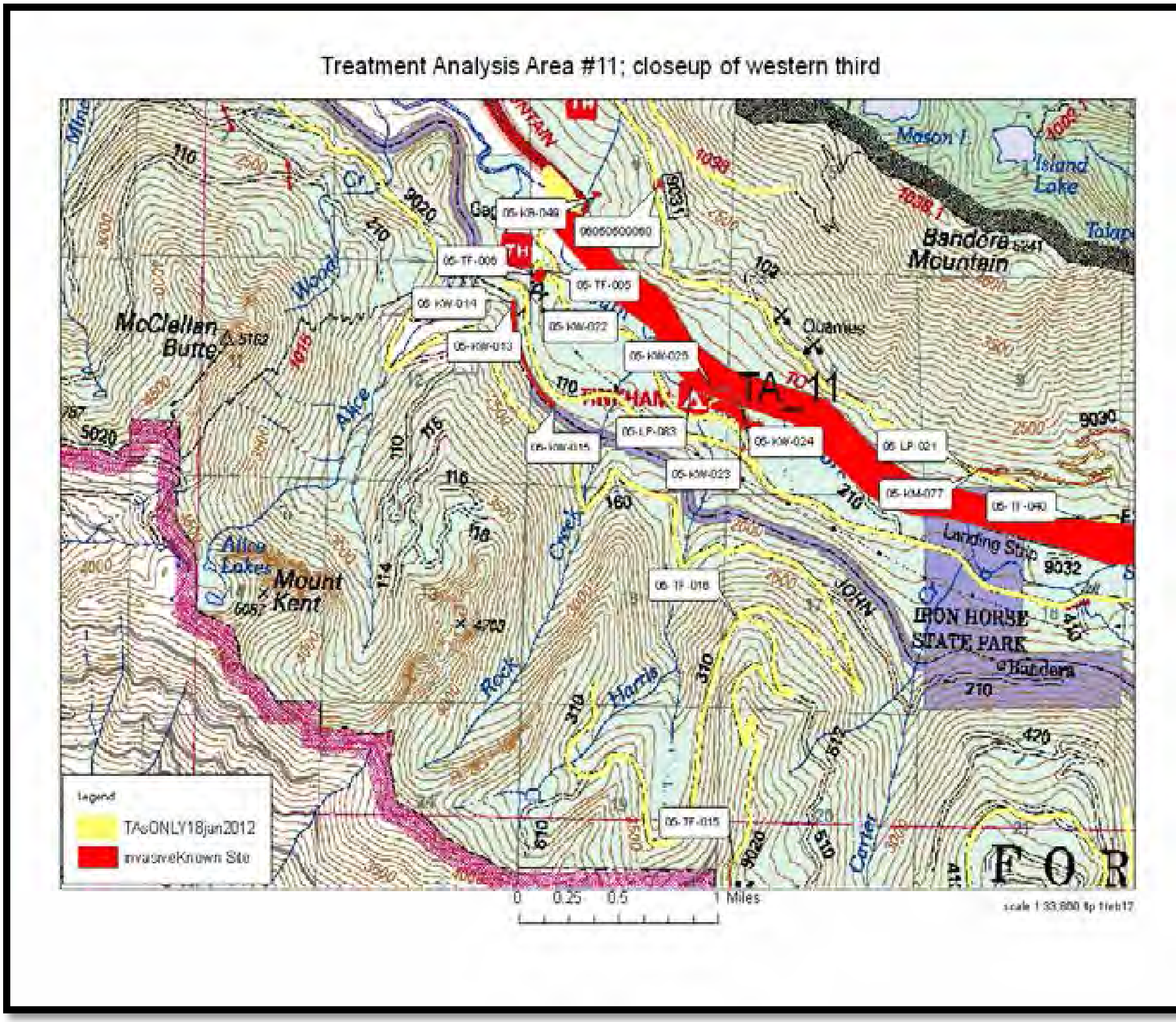

Figure A -4. Map of Treatment Analysis Area 11 Western Portion

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Appendix B – Restoration/Revegetation Strategy for Each Infested Site

Revegetation of treated invasive plant sites is proposed for the action alternatives, based on the following assumptions: Revegetation might not occur after first year if we are going to repeat treatments in consecutive years. Planting or seeding will be timed to avoid any temporary risk that might be impact desirable species according to label specifications, and/or the species being planted is not affected by the herbicide being used (e.g. grasses being used for revegetation in area where the herbicide only targets composites).

Each treatment site is classified into one of five categories:

10. **Passive Revegetation**. Site is expected to revegetate naturally because there are enough native species (or desirable non-natives (e.g. lawns in administrative sites) in the immediate vicinity to colonize once the weeds are killed. Site types include vegetated road shoulders, small areas in forested sites.
11. **None.** These are areas where revegetation is either not desirable, or not realistic, or not relevant/inappropriate. Not desirable because the area is naturally unvegetated such as a gravel bar. Not realistic if the area is constantly being graded or cleared such as boneyards or gravel pits. Inappropriate in cases such as a tree climbing vine like ivy or clematis where it would be inappropriate to replace the tree climbing species with a different species.
12. **Seed and Mulch.** This is the prescription for use where there are not enough native species in the immediate vicinity to colonize once the weeds are killed but planting is not prescribed. Examples include areas targeted for broadcast treatment. Use local native seed mix if possible, otherwise use MBS non-invasive non-native species (per Potash and Aubry 1999, as amended in 2003).
13. **Plant Rooted Stock.** For specific restoration projects, or where the weed has to be excavated in order to control it (where first-choice/first-year treatment is dig or where there’s big areas of shrub-like weeds). Some sites are already treated and planted.
14. **Planted. Past tense.** Some examples include portions of Marblemount Boat Launch, Ovenell property, Kaaland acquisition, Skiyou Island.

Table B- 1. Invasive plant species location and revegetation strategy

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
TAA 01	Evans Creek	tansy ragwort	05-LP-037	Rd 7920 Sec 8	passive
TAA 01	Evans Creek	tansy ragwort	05-LP-038	Rd 7920 Sec 19	passive
TAA 02	W Fk White River	spotted knapweed	6050500078	Rd 7400-130 staging	passive
TAA 02	W Fk White River	bull thistle	6050500163	Upper White, Rd 7400-050	passive
TAA 02	W Fk White River	Canada thistle	6050500164	Upper White, Rd 7510-410	passive
TAA 02	W Fk White River	common hawkweed	6050500165	Upper White, Rd 7510-410	passive
TAA 02	W Fk White River	Canada thistle	6050500166	Upper White, Rd 7510-710	passive
TAA 02	W Fk White River	common hawkweed	6050500167	Upper White, Rd 7510-710	passive
TAA 02	W Fk White River	Canada thistle	6050500168	Upper White, Rd 7510-300	passive
TAA 02	W Fk White River	Canada thistle	6050500169	Upper White, Rd 7510-310	passive
TAA 02	W Fk White River	common hawkweed	6050500170	Upper White, Rd 7510-310	passive
TAA 02	W Fk White River	Canada thistle	6050500183	Upper White, Rd 7400-050	passive
TAA 02	W Fk White River	Canada thistle	6050500193	Upper White, Rd 7315-310	passive
TAA 02	W Fk White River	Canada thistle	6050500194	Upper White, Rd 7315-310	passive
TAA 02	W Fk White River	Canada thistle	6050500195	Upper White, Rd 7315-310	Seed and Mulch
TAA 02	W Fk White River	bull thistle	6050500196	Upper White, Rd 7315-310	passive
TAA 02	W Fk White River	bull thistle	6050500197	Upper White, Rd 7315-310	passive
TAA 02	W Fk White River	bull thistle	6050500198	Upper White, Rd 7315-310	passive
TAA 02	W Fk White River	herb Robert	6050500200	Upper White, Rd 7315-310	passive
TAA 02	W Fk White River	Canada thistle	6050500203	Upper White, Rd 7322	passive
TAA 02	W Fk White River	Canada thistle	6050500204	Upper White, Rd 7322	passive
TAA 02	W Fk White River	bull thistle	6050500205	Upper White, Rd 7322	passive
TAA 02	W Fk White River	bull thistle	6050500206	Upper White, Rd 7322	passive
TAA 02	W Fk White River	Scotch broom	6050500207	Upper White, Rd 7322	passive
TAA 02	W Fk White River	Himalayan blackberry	6050500208	Upper White, Rd 7322	Plant rooted stock
TAA 02	W Fk White River	Canada thistle	6050500210	Upper White, Rd 7500-246	passive
TAA 02	W Fk White River	bull thistle	6050500211	Upper White, Rd 7500-246	passive
TAA 02	W Fk White River	common hawkweed	6050500212	Upper White, Rd 7500-241	passive
TAA 02	W Fk White River	Canada thistle	6050500213	Upper White, Rd 7500-412	passive
TAA 02	W Fk White River	bull thistle	6050500214	Upper White, Rd 7500-412	passive
TAA 02	W Fk White River	common hawkweed	6050500215	Upper White, Rd 7500-410	passive
TAA 02	W Fk White River	Canada thistle	6050500216	Upper White, Rd 7500-410	passive
TAA 02	W Fk White River	bull thistle	6050500217	Upper White, Rd 7500-430	passive
TAA 02	W Fk White River	Canada thistle	6050500218	Upper White, Rd 7500-430	passive

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
TAA 02	W Fk White River	Canada thistle	6050500219	Upper White, Rd 7500-510	passive
TAA 02	W Fk White River	bull thistle	6050500220	Upper White, Rd 7500-550	passive
TAA 02	W Fk White River	common hawkweed	6050500221	Upper White, Rd 7500-550	passive
TAA 02	W Fk White River	Canada thistle	6050500237	Upper White Unit 3	passive
TAA 02	W Fk White River	common hawkweed	6050500238	Upper White Unit 3	passive
TAA 02	W Fk White River	bull thistle	6050500239	Upper White Unit 3	passive
TAA 02	W Fk White River	bull thistle	6050500240	Upper White Unit 4	passive
TAA 02	W Fk White River	bull thistle	6050500241	Upper White Unit 4	passive
TAA 02	W Fk White River	Canada thistle	6050500242	Upper White Unit 4	passive
TAA 02	W Fk White River	Canada thistle	6050500243	Upper White Unit 4	passive
TAA 02	W Fk White River	herb Robert	6050500244	Upper White Unit 4	passive
TAA 02	W Fk White River	common hawkweed	6050500245	Upper White Unit 4	passive
TAA 02	W Fk White River	tansy ragwort	6050500246	Upper White Unit 4	passive
TAA 02	W Fk White River	bull thistle	6050500252	Upper White Unit 11	passive
TAA 02	W Fk White River	Canada thistle	6050500255	Upper White Unit 12	passive
TAA 02	W Fk White River	Canada thistle	6050500257	Upper White Unit 12	passive
TAA 02	W Fk White River	bull thistle	6050500258	Upper White Unit 14	passive
TAA 02	W Fk White River	bull thistle	6050500259	Upper White Unit 14	passive
TAA 02	W Fk White River	bull thistle	6050500260	Upper White Unit 14	passive
TAA 02	W Fk White River	Canada thistle	6050500261	Upper White Unit 14	passive
TAA 02	W Fk White River	herb Robert	6050500263	Upper White Unit 14	passive
TAA 02	W Fk White River	bull thistle	6050500264	Upper White Unit 15	passive
TAA 02	W Fk White River	Canada thistle	6050500265	Upper White Unit 16	passive
TAA 02	W Fk White River	Canada thistle	6050500276	Upper White Unit 16	passive
TAA 02	W Fk White River	Canada thistle	6050500277	Upper White Unit 16	passive
TAA 02	W Fk White River	common tansy	6050500279	Upper White Unit 16	passive
TAA 02	W Fk White River	bull thistle	6050500280	Upper White Unit 16	passive
TAA 02	W Fk White River	cutleaf blackberry	6050500281	Upper White Unit 17	passive
TAA 02	W Fk White River	Canada thistle	6050500282	Upper White Unit 17	passive
TAA 02	W Fk White River	Canada thistle	6050500283	Upper White Unit 17	passive
TAA 02	W Fk White River	Canada thistle	6050500284	Upper White Unit 19	passive
TAA 02	W Fk White River	Scotch broom	6050500285	Upper White Unit 19	passive
TAA 02	W Fk White River	Canada thistle	6050500287	Upper White Unit 20	passive
TAA 02	W Fk White River	Canada thistle	6050500288	Upper White Unit 21	passive
TAA 02	W Fk White River	Canada thistle	6050500289	Upper White Unit 21	passive
TAA 02	W Fk White River	Canada thistle	6050500295	Upper White Unit 21	passive

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
TAA 02	W Fk White River	bull thistle	6050500296	Upper White Unit 22	passive
TAA 02	W Fk White River	Canada thistle	6050500298	Upper White Unit 23	passive
TAA 02	W Fk White River	Canada thistle	6050500307	Upper White Unit 23	passive
TAA 02	W Fk White River	Scotch broom	6050500310	Upper White Unit 23	passive
TAA 02	W Fk White River	Scotch broom	6050500311	Upper White Unit 24	passive
TAA 02	W Fk White River	Scotch broom	6050500315	Upper White Unit 24	passive
TAA 02	W Fk White River	common groundsel	6050500316	Upper White Unit 24	passive
TAA 02	W Fk White River	Canada thistle	6050500317	Upper White Unit 24	passive
TAA 02	W Fk White River	bull thistle	6050500318	Upper White Unit 26	passive
TAA 02	W Fk White River	bull thistle	6050500319	Upper White Unit 26	passive
TAA 02	W Fk White River	Scotch broom	6050500320	Upper White Unit 26	passive
TAA 02	W Fk White River	Canada thistle	6050500321	Upper White Unit 26	passive
TAA 02	W Fk White River	herb Robert	6050500322	Upper White Unit 26	passive
TAA 02	W Fk White River	common hawkweed	6050500323	Upper White Unit 26	passive
TAA 02	W Fk White River	common groundsel	6050500324	Upper White Unit 26	passive
TAA 02	W Fk White River	Canada thistle	6050500325	Upper White Unit 27	passive
TAA 02	W Fk White River	tansy ragwort	6050500326	Upper White Unit 28	passive
TAA 02	W Fk White River	Canada thistle	6050500327	Upper White Unit 28	passive
TAA 02	W Fk White River	Scotch broom	6050500331	Upper White Unit 28	passive
TAA 02	W Fk White River	Scotch broom	6050500332	Upper White Unit 28	passive
TAA 02	W Fk White River	Scotch broom	6050500333	Upper White Unit 28	passive
TAA 02	W Fk White River	Canada thistle	6050500334	Upper White Unit 29	passive
TAA 02	W Fk White River	bull thistle	6050500335	Upper White Unit 29	passive
TAA 02	W Fk White River	Scotch broom	6050500336	Upper White Unit 29	passive
TAA 02	W Fk White River	common hawkweed	6050500337	Upper White Unit 29	passive
TAA 02	W Fk White River	Canada thistle	6050500338	Upper White Unit 30	passive
TAA 02	W Fk White River	Canada thistle	6050500339	Upper White Unit 30	passive
TAA 02	W Fk White River	common hawkweed	6050500341	Upper White Unit 30	passive
TAA 02	W Fk White River	bull thistle	6050500342	Upper White Unit 30	passive
TAA 02	W Fk White River	herb Robert	6050500343	Upper White Unit 33	passive
TAA 02	W Fk White River	herb Robert	6050500344	Upper White Unit 33	passive
TAA 02	W Fk White River	bull thistle	6050500347	Upper White Unit 35	passive
TAA 02	W Fk White River	Canada thistle	6050500348	Upper White Unit 37	passive
TAA 02	W Fk White River	bull thistle	6050500349	Upper White Unit 37	passive
TAA 02	W Fk White River	meadow knapweed	05-LP-039	Road 74, mp 4.5 to Rd 75 jct	passive
TAA 02	W Fk White River	spotted knapweed	05-LP-084	Rd 74, mp 4.5 to Rd 75 jct	Seed and Mulch

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
TAA 02	W Fk White River	tansy ragwort	05-TF-020	Rd 74, mp 4.5 to Rd 75 jct	Seed and Mulch
TAA 02	W Fk White River	diffuse knapweed	05-TF-021	Road 74, mp 4.5 to Rd 75 jct	Seed and Mulch
TAA 02	W Fk White River	tansy ragwort	05-TF-022	Rd 74, mp 2.6 & beyond	passive
TAA 02	W Fk White River	Scotch broom	05-VW-058	Rd 74, mp 2.6 & beyond	passive
TAA 02	W Fk White River	meadow knapweed	05-VW-059	Road 74 near Thirsty Ck	passive
TAA 02	W Fk White River	Scotch broom	05-VW-061	Road 74	passive
TAA 02	W Fk White River	Scotch broom	05-VW-062	Road 74	passive
TAA 02	W Fk White River	Scotch broom	05-VW-063	Road 7415-405	passive
TAA 02	W Fk White River	tansy ragwort	05-VW-064	Road 75	passive
TAA 02	W Fk White River	tansy ragwort	05-VW-066	Road 74 near watertanks	passive
TAA 02	W Fk White River	tansy ragwort	05-VW-067	Road 74 near Palisades	passive
TAA 02	W Fk White River	spotted knapweed	05-VW-077	Road 74 near Thirsty Ck	passive
TAA 02	W Fk White River	Canada thistle	6050500262	Upper White Unit 14	passive
TAA 02	W Fk White River	bull thistle	6050500330	Upper White Unit 28	passive
TAA 02	W Fk White River	bull thistle	6050500346	Upper White Unit 34	passive
TAA 03	Greenwater River	herb Robert	6050500009	Elk Forage, old spur 7200-226	passive
TAA 03	Greenwater River	tansy ragwort	6050500010	Elk Forage, old spur 7200-226	passive
TAA 03	Greenwater River	bull thistle	6050500011	Elk Forage, Rd 70 @ MP 5	passive
TAA 03	Greenwater River	common hawkweed	6050500012	Elk Forage, Rd 70 @ MP 5	passive
TAA 03	Greenwater River	Scotch broom	6050500013	Elk Forage, Rd 70 @ MP 5	passive
TAA 03	Greenwater River	Scotch broom	6050500018	Lower 28 mile rock pit	None
TAA 03	Greenwater River	Scotch broom	6050500019	Upper 28 mile stock pile	None
TAA 03	Greenwater River	common hawkweed	6050500020	Road 70 and 7080	Seed and Mulch
TAA 03	Greenwater River	herb Robert	6050500061	Grnwtr Chinook acclimation pond	passive
TAA 03	Greenwater River	Canada thistle	6050500068	Elk Forage Unit 51	passive
TAA 03	Greenwater River	Canada thistle	6050500069	Elk Forage Unit 52	passive
TAA 03	Greenwater River	Canada thistle	6050500070	Elk Forage Unit 54	passive
TAA 03	Greenwater River	spotted knapweed	6050500076	70 Road upper	passive
TAA 03	Greenwater River	Canada thistle	6050500077	Road 70 &70-210	passive
TAA 03	Greenwater River	Canada thistle	6050500079	Elk Forage Unit 55	passive
TAA 03	Greenwater River	bull thistle	6050500080	Elk Forage Unit 55	passive
TAA 03	Greenwater River	bull thistle	6050500081	Elk Forage Unit 55	passive
TAA 03	Greenwater River	spotted knapweed	6050500082	Rd 7030 MP 0.3	passive

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
TAA 03	Greenwater River	Canada thistle	6050500083	Elk Forage Unit 56	passive
TAA 03	Greenwater River	bull thistle	6050500084	Elk Forage Unit 56	passive
TAA 03	Greenwater River	common hawkweed	6050500085	Elk Forage Unit 56	passive
TAA 03	Greenwater River	Canada thistle	6050500086	Elk Forage Unit 58	passive
TAA 03	Greenwater River	common hawkweed	6050500087	Elk Forage Unit 58	passive
TAA 03	Greenwater River	Canada thistle	6050500088	Elk Forage Unit 59	passive
TAA 03	Greenwater River	Scotch broom	6050500089	Elk Forage Unit 59	passive
TAA 03	Greenwater River	common hawkweed	6050500090	Elk Forage Unit 59	passive
TAA 03	Greenwater River	common hawkweed	6050500091	Elk Forage Unit 59	passive
TAA 03	Greenwater River	bull thistle	6050500093	Elk Forage Unit 59	passive
TAA 03	Greenwater River	Canada thistle	6050500094	Elk Forage Unit 60	passive
TAA 03	Greenwater River	tansy ragwort	6050500095	Elk Forage Unit 60	passive
TAA 03	Greenwater River	Canada thistle	6050500096	Elk Forage Unit 62	passive
TAA 03	Greenwater River	bull thistle	6050500097	Elk Forage Unit 62	passive
TAA 03	Greenwater River	common hawkweed	6050500098	Elk Forage Unit 62	passive
TAA 03	Greenwater River	Canada thistle	6050500100	Elk Forage Unit 64	passive
TAA 03	Greenwater River	common hawkweed	6050500101	Elk Forage Unit 64	passive
TAA 03	Greenwater River	Canada thistle	6050500102	Elk Forage Unit 65	passive
TAA 03	Greenwater River	bull thistle	6050500103	Elk Forage Unit 65	passive
TAA 03	Greenwater River	Canada thistle	6050500104	Elk Forage Unit 66	passive
TAA 03	Greenwater River	bull thistle	6050500105	Elk Forage Unit 66	passive
TAA 03	Greenwater River	common groundsel	6050500106	Elk Forage Unit 66	passive
TAA 03	Greenwater River	Canada thistle	6050500107	Elk Forage Unit 67	passive
TAA 03	Greenwater River	common hawkweed	6050500108	Elk Forage Unit 67	passive
TAA 03	Greenwater River	Canada thistle	6050500109	Elk Forage Unit 68	passive
TAA 03	Greenwater River	bull thistle	6050500110	Elk Forage Unit 68	passive
TAA 03	Greenwater River	herb Robert	6050500111	Elk Forage Unit 68	passive
TAA 03	Greenwater River	common hawkweed	6050500112	Elk Forage Unit 68	passive
TAA 03	Greenwater River	tansy ragwort	6050500113	Elk Forage Unit 68	passive
TAA 03	Greenwater River	Canada thistle	6050500114	Elk Forage Unit 69	passive
TAA 03	Greenwater River	bull thistle	6050500115	Elk Forage Unit 69	passive
TAA 03	Greenwater River	bull thistle	6050500116	Elk Forage Unit 69	passive
TAA 03	Greenwater River	Scotch broom	6050500117	Elk Forage Unit 69	passive
TAA 03	Greenwater River	herb Robert	6050500118	Elk Forage Unit 69	passive
TAA 03	Greenwater River	common hawkweed	6050500119	Elk Forage Unit 69	passive
TAA 03	Greenwater River	common tansy	6050500120	Elk Forage Unit 69	passive

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
TAA 03	Greenwater River	Canada thistle	6050500121	Elk Forage Unit 71	passive
TAA 03	Greenwater River	bull thistle	6050500122	Elk Forage Unit 71	passive
TAA 03	Greenwater River	common hawkweed	6050500123	Elk Forage Unit 71	passive
TAA 03	Greenwater River	Canada thistle	6050500124	Elk Forage Unit 72	passive
TAA 03	Greenwater River	bull thistle	6050500125	Elk Forage Unit 72	passive
TAA 03	Greenwater River	herb Robert	6050500126	Elk Forage Unit 72	passive
TAA 03	Greenwater River	common hawkweed	6050500127	Elk Forage Unit 72	passive
TAA 03	Greenwater River	Canada thistle	6050500128	Elk Forage Unit 73	passive
TAA 03	Greenwater River	bull thistle	6050500129	Elk Forage Unit 73	passive
TAA 03	Greenwater River	Scotch broom	6050500130	Elk Forage Unit 73	passive
TAA 03	Greenwater River	Scotch broom	6050500131	Elk Forage Unit 73	passive
TAA 03	Greenwater River	common hawkweed	6050500132	Elk Forage Unit 73	passive
TAA 03	Greenwater River	common hawkweed	6050500133	Elk Forage Unit 73	passive
TAA 03	Greenwater River	common hawkweed	6050500134	Elk Forage Unit 73	passive
TAA 03	Greenwater River	Canada thistle	6050500135	Elk Forage Unit 74	passive
TAA 03	Greenwater River	bull thistle	6050500136	Elk Forage Unit 74	passive
TAA 03	Greenwater River	spotted knapweed	6050500137	Elk Forage Unit 75	passive
TAA 03	Greenwater River	wild carrot	6050500138	Elk Forage Unit 75	passive
TAA 03	Greenwater River	Canada thistle	6050500139	Elk Forage Unit 79	passive
TAA 03	Greenwater River	bull thistle	6050500140	Elk Forage Unit 79	passive
TAA 03	Greenwater River	common hawkweed	6050500141	Elk Forage Unit 79	passive
TAA 03	Greenwater River	Canada thistle	6050500142	Elk Forage Unit 80	passive
TAA 03	Greenwater River	Canada thistle	6050500146	Elk Forage Unit 81	passive
TAA 03	Greenwater River	Canada thistle	6050500147	Elk Forage Unit 82	passive
TAA 03	Greenwater River	Canada thistle	6050500148	Elk Forage Unit 83	passive
TAA 03	Greenwater River	Canada thistle	6050500149	Elk Forage Unit 84	passive
TAA 03	Greenwater River	Canada thistle	6050500150	Elk Forage Unit 84	passive
TAA 03	Greenwater River	Canada thistle	6050500151	Elk Forage Unit 85	passive
TAA 03	Greenwater River	Canada thistle	6050500152	Elk Forage Unit 86	passive
TAA 03	Greenwater River	Canada thistle	6050500153	Elk Forage Unit 86	passive
TAA 03	Greenwater River	Canada thistle	6050500154	Elk Forage Unit 87	passive
TAA 03	Greenwater River	Canada thistle	6050500155	Elk Forage Unit 88	passive
TAA 03	Greenwater River	herb Robert	05-KW-001	Road 70	passive
TAA 03	Greenwater River	tansy ragwort	05-KW-016	Road 7012/7020	passive
TAA 03	Greenwater River	tansy ragwort	05-LP-010	Road 7010	passive
TAA 03	Greenwater River	Scotch broom	05-LP-087	Greenwater gravel bar,	None

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
				banks, old rd 70	
TAA 03	Greenwater River	Canada thistle	05-SJ-001	Road 7012-360	passive
TAA 03	Greenwater River	bull thistle	05-SJ-002	Road 7012-360	passive
TAA 03	Greenwater River	Canada thistle	05-SJ-003	Road 7020-110	passive
TAA 03	Greenwater River	bull thistle	05-SJ-004	Road 7020-110	passive
TAA 03	Greenwater River	spotted knapweed	05-TF-008	Road 70 and gravel bar	passive
TAA 03	Greenwater River	tansy ragwort	05-TF-009	Road 70/Road 410 junction	Seed and Mulch
TAA 03	Greenwater River	smooth hawkweed	05-TF-010	Road 70	Seed and Mulch
TAA 03	Greenwater River	spotted knapweed	05-TF-011	Greenwater gravel bar, banks (revisit)	None
TAA 03	Greenwater River	spotted knapweed	05-TF-028	Old Rd 70	passive
TAA 03	Greenwater River	tansy ragwort	05-VW-055	Road 72, sec 34	passive
TAA 03	Greenwater River	diffuse knapweed	05-VW-056	Road 70	passive
TAA 03	Greenwater River	tansy ragwort	05-VW-057	Road 70 & 7080	passive
TAA 03	Greenwater River	spotted knapweed	05-VW-075	Road 70	Seed and Mulch
TAA 03	Greenwater River	tansy ragwort	05-VW-076	Road 70	passive
TAA 04	The Dalles	Scotch broom	6050500008	Mather Pkwy, Mt. Rainier viewpoint	passive
TAA 04	The Dalles	bull thistle	6050500014	Boundary Creek compound	None
TAA 04	The Dalles	Scotch broom	6050500015	Cow Flats stockpile	None
TAA 04	The Dalles	Canada thistle	6050500063	Elk Forage Unit 50	passive
TAA 04	The Dalles	Canada thistle	6050500064	Elk Forage Unit 50	passive
TAA 04	The Dalles	bull thistle	6050500065	Elk Forage Unit 50	passive
TAA 04	The Dalles	bull thistle	6050500066	Elk Forage Unit 50	passive
TAA 04	The Dalles	common hawkweed	6050500067	Elk Forage Unit 50	passive
TAA 04	The Dalles	Canada thistle	6050500173	Upper White, Rd 7305	Seed and Mulch
TAA 04	The Dalles	tansy ragwort	6050500174	Upper White, Rd 7305	passive
TAA 04	The Dalles	bull thistle	6050500176	Upper White, Rd 7305	passive
TAA 04	The Dalles	Scotch broom	6050500179	Upper White, Rd 7305	passive
TAA 04	The Dalles	common hawkweed	6050500180	Upper White, Rd 7305	passive
TAA 04	The Dalles	Canada thistle	6050500181	Upper White, Rd 7305-110	passive
TAA 04	The Dalles	bull thistle	6050500182	Upper White, Rd 7305-110	passive
TAA 04	The Dalles	tansy ragwort	6050500184	Upper White, Rd 7305-110	passive
TAA 04	The Dalles	Canada thistle	6050500185	Upper White, Rd 7305-210	passive
TAA 04	The Dalles	bull thistle	6050500186	Upper White, Rd 7305-210	passive
TAA 04	The Dalles	Scotch broom	6050500187	Upper White, Rd 7305-210	passive

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
TAA 04	The Dalles	Canada thistle	6050500192	Upper White, Rd 7315-160	passive
TAA 04	The Dalles	Canada thistle	6050500193	Upper White, Rd 7315-310	passive
TAA 04	The Dalles	bull thistle	6050500196	Upper White, Rd 7315-310	passive
TAA 04	The Dalles	Scotch broom	6050500199	Upper White, Rd 7315-310	passive
TAA 04	The Dalles	tansy ragwort	6050500201	Upper White, Rd 7315-310	passive
TAA 04	The Dalles	herb Robert	6050500222	Upper White, Rd 7150-210	passive
TAA 04	The Dalles	Canada thistle	6050500223	Upper White, Rd 7146	passive
TAA 04	The Dalles	Canada thistle	6050500224	Upper White, Rd 7146	passive
TAA 04	The Dalles	bull thistle	6050500225	Upper White, Rd 7146	passive
TAA 04	The Dalles	herb Robert	6050500226	Upper White, Rd 7146	passive
TAA 04	The Dalles	herb Robert	6050500227	Upper White, Rd 7146	passive
TAA 04	The Dalles	Scotch broom	6050500228	McCullough Seed Orchard	passive
TAA 04	The Dalles	Scotch broom	6050500229	McCullough Seed Orchard	passive
TAA 04	The Dalles	Canada thistle	6050500230	McCullough Seed Orchard	passive
TAA 04	The Dalles	Canada thistle	6050500231	McCullough Seed Orchard	passive
TAA 04	The Dalles	bull thistle	6050500232	McCullough Seed Orchard	passive
TAA 04	The Dalles	bull thistle	6050500241	Upper White Unit 4	passive
TAA 04	The Dalles	Canada thistle	6050500242	Upper White Unit 4	passive
TAA 04	The Dalles	Canada thistle	6050500247	Upper White Unit 5	passive
TAA 04	The Dalles	herb Robert	6050500248	Upper White Unit 5	passive
TAA 04	The Dalles	Canada thistle	6050500249	Upper White Unit 6	passive
TAA 04	The Dalles	Canada thistle	6050500250	Upper White Unit 6	passive
TAA 04	The Dalles	Canada thistle	6050500251	Upper White Unit 10	passive
TAA 04	The Dalles	herb Robert	6050500253	Upper White Unit 11	passive
TAA 04	The Dalles	Canada thistle	6050500254	Upper White Unit 11	passive
TAA 04	The Dalles	common hawkweed	6050500380	Upper White Thin Unit 9	passive
TAA 04	The Dalles	Canada thistle	6050500381	Puyallup Thin Unit 9	passive
TAA 04	The Dalles	common hawkweed	05-KW-028	McCullough Seed and Mulch Orchard	Seed and Mulch
TAA 04	The Dalles	Scotch broom	05-KW-029	McCullough Seed Orchard	passive
TAA 04	The Dalles	Canada thistle	05-KW-030	McCullough Seed Orchard	passive
TAA 04	The Dalles	bull thistle	05-KW-031	McCullough Seed Orchard	passive
TAA 04	The Dalles	bird's foot trefoil	05-KW-032	McCullough Seed Orchard	passive
TAA 04	The Dalles	hairy cat's ear	05-KW-033	McCullough Seed and Mulch Orchard	Seed and Mulch
TAA 04	The Dalles	oxeye daisy	05-KW-034	McCullough Seed and Mulch	Seed and Mulch

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
				Orchard	
TAA 04	The Dalles	St John's wort	05-KW-035	McCullough Seed and Mulch Orchard	Seed and Mulch
TAA 04	The Dalles	tansy ragwort	05-KW-041	McCullough Seed Orchard	passive
TAA 04	The Dalles	Scotch broom	05-LP-040	Huckleberry Army Camp (revisit)	Seed and Mulch
TAA 04	The Dalles	Bohemian knotweed	05-TF-012	Huckleberry Army Camp	passive
TAA 04	The Dalles	tansy ragwort	05-TF-013	Road 72, sec 5	passive
TAA 04	The Dalles	spotted knapweed	05-TF-014	Road 7305-200	passive
TAA 04	The Dalles	tansy ragwort	05-TF-026	The Dalles Rec Residence #27	Plant rooted stock
TAA 04	The Dalles	tansy ragwort	05-TF-030	Elk forage unit #31western	passive
TAA 04	The Dalles	tansy ragwort	05-TF-031	Elk forage unit #31 middle	passive
TAA 04	The Dalles	tansy ragwort	05-TF-032	Elk forage unit #31 eastern	passive
TAA 04	The Dalles	Scotch broom	05-TF-039	Boundary Ck Boneyard & Stockpile	None
TAA 04	The Dalles	tansy ragwort	05-VW-054	Minnehaha	Seed and Mulch
TAA 04	The Dalles	Scotch broom	05-VW-065	Road 73/7305 junction	passive
TAA 05	The Dalles	tansy ragwort	6050500188	Upper White, Rd 7305-210	passive
TAA 05	The Dalles	common hawkweed	6050500233	Upper White Unit 2	passive
TAA 05	Ranger Creek	Scotch broom	05-LP-089	Ranger Creek Airstrip	Seed and Mulch
TAA 05	Ranger Creek	tansy ragwort	05-TF-007	Buck Creek Camp	passive
TAA 05	The Dalles	tansy ragwort	05-TF-017	Road 7200-011	passive
TAA 05	Ranger Creek	spotted knapweed	05-TF-018	Ranger Creek Airstrip	Seed and Mulch
TAA 05	Ranger Creek	Bohemian knotweed	05-TF-025	Silver Springs Rec Residence #122	Plant rooted stock
TAA 05	Ranger Creek	Rhododendron	05-TF-027	Silver Springs Rec Residence #122	Plant rooted stock
TAA 05	Ranger Creek	European lily of the valley	05-TF-029	Silver Springs Rec Residence #93	passive
TAA 05	Ranger Creek	tansy ragwort	05-TF-033	Silver Springs Rec Residence #86	Plant rooted stock
TAA 06	The Dalles	common groundsel	6050500189	Upper White, Rd 7305-210	passive
TAA 06	The Dalles	bull thistle	6050500234	Upper White Unit 2	passive
TAA 06	Crystal Mountain Blvd	bull thistle	05-LP-088	Crystal Mtn Parking area	passive
TAA 07	The Dalles	bull thistle	6050500190	Upper White, Rd 7315-410	passive
TAA 07	The Dalles	Scotch broom	6050500235	Upper White Unit 2	passive

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
TAA 07	Sunday Creek	tansy ragwort	05-AR-072	Road 54 Stampede Pass	Seed and Mulch
TAA 07	Sunday Creek	tansy ragwort	05-KM-009	Stampede Pass, Rd 50	Seed and Mulch
TAA 07	Sunday Creek	spotted knapweed	05-KM-080	Rd 54 Stampede Pass (revisit)	None
TAA 07	Sunday Creek	tansy ragwort	05-KW-019	Road 54 Stampede Pass	passive
TAA 07	Sunday Creek	tansy ragwort	05-KW-020	Road 54 Stampede Pass	passive
TAA 07	Sunday Creek	spotted knapweed	05-KW-036	Road 54 Stampede Pass, mp 11.9	Seed and Mulch
TAA 08	Road 52	sulphur cinquefoil	6050500021	Rd 52, Tacoma Pass stockpile	None
TAA 08	Road 52	spotted knapweed	6050500022	Rd 52, Pioneer Creek	None
TAA 08	The Dalles	Canada thistle	6050500236	Upper White Unit 2	passive
TAA 08	Road 52	tansy ragwort	05-AR-071	Road 52 near Tacoma Pass	Seed and Mulch
TAA 11	I-90 Corridor King County	orange hawkweed	6050500016	Alpental roads 9040 & PCT lots	passive
TAA 11	I-90 Corridor King County	spotted knapweed	6050500023	Granite Mtn. trailhead	None
TAA 11	I-90 Corridor King County	orange hawkweed	6050500024	Alpental ski area	passive
TAA 11	I-90 Corridor King County	Bohemian knotweed	6050500060	Road 9031 milepost 2.8	passive
TAA 11	I-90 Corridor King County	absinth wormwood	6050500062	Denny Creek Road	passive
TAA 11	I-90 Corridor King County	orange hawkweed	6050500071	Denny Creek Road	passive
TAA 11	I-90 Corridor King County	meadow hawkweed	6050500072	Denny Creek Road	passive
TAA 11	I-90 Corridor King County	common hawkweed	6050500073	Denny Creek Road	passive
TAA 11	I-90 Corridor King County	yellow archangel	05-AR-073	Denny Ck Rec Res #4	Plant rooted stock
TAA 11	I-90 Corridor King County	spotted knapweed	05-DL-001	Asahel Curtis trailhead	passive
TAA 11	I-90 Corridor King County	Bohemian knotweed	05-KB-049	Mason Ck; Menke acquisition(a.k.a. I-90 Exit42)	None
TAA 11	I-90 Corridor King County	Scotch broom	05-KM-007	Bandera/Rd 5510&110 spur	passive

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
TAA 11	I-90 Corridor King County	Scotch broom	05-KM-008	Bandera; Rd 5510-160	Seed and Mulch
TAA 11	I-90 Corridor King County	Scotch broom	05-KM-077	Road 9030	Seed and Mulch
TAA 11	I-90 Corridor King County	dalmatian toadflax	05-KM-078	RR tracks @ Humpback Ck	passive
TAA 11	I-90 Corridor King County	orange hawkweed	05-KM-079	"I-90 below underpass,Wbound lanes	passive
TAA 11	I-90 Corridor King County	tansy ragwort	05-KW-002	Pratt R. stockpile/ borrow pit	None
TAA 11	I-90 Corridor King County	herb Robert	05-KW-003	Pratt R. stockpile/ borrow pit	None
TAA 11	I-90 Corridor King County	sulphur cinquefoil	05-KW-004	Pratt R. stockpile/ borrow pit	None
TAA 11	I-90 Corridor King County	Scotch broom	05-KW-005	Pratt R. stockpile/ borrow pit	None
TAA 11	I-90 Corridor King County	orange hawkweed	05-KW-006	Pratt R. stockpile/ borrow pit	None
TAA 11	I-90 Corridor King County	spotted knapweed	05-KW-007	Pratt R. stockpile/ borrow pit	None
TAA 11	I-90 Corridor King County	Scotch broom	05-KW-013	John Wayne Trail	None
TAA 11	I-90 Corridor King County	dalmatian toadflax	05-KW-014	John Wayne Trail	None
TAA 11	I-90 Corridor King County	spotted knapweed	05-KW-015	John Wayne Trail	passive
TAA 11	I-90 Corridor King County	sulphur cinquefoil	05-KW-022	McClellan Butte Trailhead	passive
TAA 11	I-90 Corridor King County	herb Robert	05-KW-023	Tinkham Campground	passive
TAA 11	I-90 Corridor King County	tansy ragwort	05-KW-024	S Fk Snoqualmie Gravel Bars	None
TAA 11	I-90 Corridor King County	spotted knapweed	05-KW-025	S Fk Snoqualmie Gravel Bars	None
TAA 11	I-90 Corridor King County	spotted knapweed	05-KW-026	Snow Lake parking lot	Seed and Mulch
TAA 11	I-90 Corridor King	orange hawkweed	05-KW-027	Snow Lake Trailhead	passive

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
	County				
TAA 11	I-90 Corridor King County	tansy ragwort	05-KW-037	Rd 5510-310	passive
TAA 11	I-90 Corridor King County	woolly hedgenettle	05-KW-038	Rd 5510-410, sec 21	passive
TAA 11	I-90 Corridor King County	tansy ragwort	05-KW-039	Rd 5510 Hansen Creek	passive
TAA 11	I-90 Corridor King County	spotted knapweed	05-KW-040	Rd 5510-410, sec 28	passive
TAA 11	I-90 Corridor King County	Bohemian knotweed	05-LP-021	Mason Lake Rd	passive
TAA 11	I-90 Corridor King County	meadow knapweed	05-TF-001	Road 5800	passive
TAA 11	I-90 Corridor King County	tansy ragwort	05-TF-002	Road 5800	passive
TAA 11	I-90 Corridor King County	spotted knapweed	05-TF-003	Road 5800 East (revisit)	passive
TAA 11	I-90 Corridor King County	orange hawkweed	05-TF-004	Road 5800/9040 junction	passive
TAA 11	I-90 Corridor King County	herb Robert	05-TF-005	McClellan Butte TH	passive
TAA 11	I-90 Corridor King County	spotted knapweed	05-TF-006	McClellan Butte TH	passive
TAA 11	I-90 Corridor King County	common hawkweed	05-TF-015	Road 9020	passive
TAA 11	I-90 Corridor King County	Scotch broom	05-TF-016	Road 9020, milepost 7.6	passive
TAA 11	I-90 Corridor King County	Bohemian knotweed	05-TF-040	9030 Rd	passive
TAA 11	I-90 Corridor King County	dalmatian toadflax	05-TF-076	Pratt R. stockpile/ borrow pit	none
TAA 11	I-90 Corridor King County	orange hawkweed	05-VW-074	Commonwealth Campground	passive
TAA 11	I-90 Corridor King County	dalmatian toadflax	05-LP-083	I-90 m.p. 38 to MBS boundary	passive
TAA 11	I-90 Corridor King County	yellow archangel	05-TF-023	Denny Ck Rec Res #4	plant rooted stock

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
TAA 12	Middle Fork Snoqualmie River	Scotch broom	05-BS-001	Mid Fk Snoq Rd, .5 mi from end	passive
TAA 12	Middle Fork Snoqualmie River	common tansy	05-KC-011	MidFk Snoq - Taylor River bridge	passive
TAA 12	Middle Fork Snoqualmie River	Scotch broom	05-KC-028	MidFk Snoq - FS Rd 210	passive
TAA 12	Middle Fork Snoqualmie River	common comfrey	05-KC-029	MidFk Snoq - FS Rd 210	passive
TAA 12	Middle Fork Snoqualmie River	field bindweed	05-KC-030	MidFk Snoq - FS Rd 210	passive
TAA 12	Middle Fork Snoqualmie River	common periwinkle	05-KC-033	MidFk Snoq - FS Rd 210	passive
TAA 12	Middle Fork Snoqualmie River	common tansy	05-KC-036	MidFk Snoq - Quarry .8 mi from Goldmeyer turnoff	None
TAA 12	Middle Fork Snoqualmie River	rhubarb	05-KC-042	MidFk Snoq - 520 Rd closure	Plant rooted stock
TAA 12	Middle Fork Snoqualmie River	field bindweed	05-KC-043	MidFk Snoq - 520 Rd closure	passive
TAA 12	Middle Fork Snoqualmie River	Scotch broom	05-KC-113	MidFk Snoq - 510 Rd corridor	passive
TAA 12	Middle Fork Snoqualmie River	tansy ragwort	05-KC-123	MidFk Snoq - mid Fk trailhd, old cmp ground	passive
TAA 12	Middle Fork Snoqualmie River	butterfly bush	05-KC-124	MidFk Snoq - 4 mi from concrete bridge	passive
TAA 12	Middle Fork Snoqualmie River	Scotch broom	05-KC-141	MidFk Snoq - btween campsite and CCC rd	passive
TAA 12	Middle Fork Snoqualmie River	butterfly bush	05-KC-142	MidFk Snoq - near CCC trailhead	passive
TAA 12	Middle Fork Snoqualmie River	butterfly bush	05-KC-143	MidFk Snoq - milepost 4.3-4.6 (from concrete bridge)	passive
TAA 12	Middle Fork Snoqualmie River	tansy ragwort	05-KC-214	MidFk Snoq - btwn mid fk trailhead and taylor river bridge	passive
TAA 12	Middle Fork Snoqualmie River	tansy ragwort	05-KC-241	MidFk Snoq - 1.25 mi E of FS Rd 210	passive
TAA 12	Middle Fork Snoqualmie River	tansy ragwort	05-KC-247	MidFk Snoq - 0.15 mi W of FS Rd 210	passive

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
TAA 12	Middle Fork Snoqualmie River	tansy ragwort	05-KC-261	MidFk Snoq - 0.1 mi W of FS Rd 210	passive
TAA 12	Middle Fork Snoqualmie River	tansy ragwort	05-KC-271	MidFk Snoq - 0.2 mi W of Rd 210 near CCC trailhead	passive
TAA 12	Middle Fork Snoqualmie River	butterfly bush	05-KC-282	MidFk Snoq - 0.26 mi W of CCC road	passive
TAA 12	Middle Fork Snoqualmie River	butterfly bush	05-KC-288	MidFk Snoq - 0.4 mi W of CCC road	passive
TAA 12	Middle Fork Snoqualmie River	butterfly bush	05-KC-293	MidFk Snoq - 0.5 mi W of CCC road	passive
TAA 12	Middle Fork Snoqualmie River	common tansy	05-KC-373	MidFk Snoq - 7 mi E of Dingford trailhead	passive
TAA 12	Middle Fork Snoqualmie River	Scotch broom	05-KC-374	MidFk Snoq - 7.1 mi E of Dingford trailhead	passive
TAA 12	Middle Fork Snoqualmie River	Scotch broom	05-KC-375	MidFk Snoq - 7.2 mi E of Dingford trailhead	passive
TAA 12	Middle Fork Snoqualmie River	common tansy	05-KC-377	MidFk Snoq - Dutch Miller trailhead	passive
TAA 12	Middle Fork Snoqualmie River	field bindweed	05-KC-389	MidFk Snoq - 1.9 mi w of Dingford trailhead	passive
TAA 12	Middle Fork Snoqualmie River	tansy ragwort	05-KC-423	MidFk Snoq - btwn CCC Rd and campsite area	passive
TAA 12	Middle Fork Snoqualmie River	hedge false bindweed	05-KC-426	MidFk Snoq - 1.4 mi E of Moore prop access	passive
TAA 12	Middle Fork Snoqualmie River	herb Robert	05-LP-075	E of Dingford Ck Trailhead	passive
TAA 12	Middle Fork Snoqualmie River	butterfly bush	05-LP-085	Mid Fork Snoqualmie Road, milepost 9.2	passive
TAA 12	Middle Fork Snoqualmie River	herb Robert	05-LP-086	Mid Fork Snoqualmie Road, near milepost 9.2	passive
TAA 12	Middle Fork Snoqualmie River	field bindweed	05-TQ-069	Mid Fork Snoqualmie Road, near milepost 16 (revisit)	passive
TAA 13	Bessemer Road System	Bohemian knotweed	6050500074	Bessemer Road-decommissioned	passive
TAA 13	Bessemer Road System	Bohemian knotweed	6050500075	Bessemer Road	passive
TAA 14	Snoqualmie Point	butterfly bush	05-TF-034	Snoqualmie Point Stewardship	Plant rooted stock

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
TAA 14	Snoqualmie Point	Scotch broom	05-TF-035	Snoqualmie Point Stewardship	Plant rooted stock
TAA 14	Snoqualmie Point	Himalayan blackberry	05-TF-036	Snoqualmie Point Stewardship	Plant rooted stock
TAA 14	Snoqualmie Point	cutleaf blackberry	05-TF-037	Snoqualmie Point Stewardship	Plant rooted stock
TAA 14	Snoqualmie Point	tansy ragwort	05-TF-038	Snoqualmie Point Stewardship	passive
TAA 15	Martin Creek-Tye River	common tansy	6050600019	Rd 6710230/Kelley Creek Trail	passive
TAA 15	Martin Creek-Tye River	yellow hawkweed	6050600053	Rd 6710	passive
TAA 15	Martin Creek-Tye River	orange hawkweed	6050600054	Rd 6710	passive
TAA 15	Martin Creek-Tye River	tansy ragwort	6050600055	Rd 6710-236	passive
TAA 15	Martin Creek-Tye River	bull thistle	6050600072	Sky-Beckler Thin Unit 63	passive
TAA 15	Martin Creek-Tye River	yellow hawkweed	06-AR-085	Road 6066/6067	Seed and Mulch
TAA 15	Martin Creek-Tye River	Bohemian knotweed	06-BS-001	Hwy 2, milepost 52.5	passive
TAA 15	Martin Creek-Tye River	Bohemian knotweed	06-BS-002	Rd 67, milepost 3.5	passive
TAA 15	Martin Creek-Tye River	Bohemian knotweed	06-DL-002	Tye River	Plant rooted stock
TAA 15	Martin Creek-Tye River	dalmatian toadflax	06-SJ-010	WSDOT avalanche control, Road 2	passive
TAA 15	Martin Creek-Tye River	giant hogweed	06-LP-035	Hwy 2 near Deception falls	passive
TAA 15	Martin Creek-Tye River	dalmatian toadflax	06-SJ-001	WSDOT stockpile, Road 2	None
TAA 15	Martin Creek-Tye River	herb Robert	06-SJ-013	Hwy 2 stabilization Tye River	passive
TAA 15	Martin Creek-Tye River	Bohemian knotweed	06-SM-001	Rd 67, milepost 2.6	passive
TAA 15	Martin Creek-Tye River	Bohemian knotweed	06-SM-002	Rd 67, milepost 3.0	passive
TAA 15	Martin Creek-Tye River	Bohemian knotweed	06-SM-003	Rd 67, milepost 3.2	passive
TAA 15	Martin Creek-Tye River	Bohemian knotweed	06-SM-004	E of Scenic in RR yard	passive
TAA 16	Lower Beckler River	Japanese knotweed	6050600008	Rd 65, opposite Beckler River CG	None
TAA 16	Lower Beckler River	Himalayan blackberry	6050600009	Rd 6500-104 stockpile	None
TAA 16	Lower Beckler River	Japanese knotweed	6050600010	Rd 6500-104 stockpile	None
TAA 16	Lower Beckler River	herb Robert	6050600036	Beckler Pit	None
TAA 16	Lower Beckler River	sulphur cinquefoil	6050600037	Beckler Pit	None
TAA 16	Lower Beckler River	Canada thistle	6050600038	Beckler Pit	None
TAA 16	Lower Beckler River	yellow hawkweed	6050600047	6514 Rd	passive
TAA 16	Lower Beckler River	Himalayan blackberry	6050600048	6514 Rd	passive
TAA 16	Lower Beckler River	herb Robert	6050600049	Sky-Beckler Thin Unit 51	passive

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
TAA 16	Lower Beckler River	common hawkweed	6050600050	6514 Rd	passive
TAA 16	Lower Beckler River	tall hawkweed	6050600051	6514 Rd	passive
TAA 16	Lower Beckler River	yellow hawkweed	6050600052	Road 6514-409	passive
TAA 16	Lower Beckler River	herb Robert	6050600079	Sky-Beckler Thin Unit65	passive
TAA 16	Lower Beckler River	herb Robert	6050600135	Beckler Thin Unit 51	passive
TAA 16	Lower Beckler River	bull thistle	6050600136	Beckler Thin Unit 55A	passive
TAA 16	Lower Beckler River	bull thistle	6050600137	Beckler Thin Unit 55A	passive
TAA 16	Lower Beckler River	bull thistle	6050600138	Beckler Thin Unit 55A	passive
TAA 16	Lower Beckler River	bull thistle	6050600139	Beckler Thin Unit 55A	passive
TAA 16	Lower Beckler River	herb Robert	6050600142	Beckler Thin Unit 55B	passive
TAA 16	Lower Beckler River	herb Robert	6050600143	Beckler Thin Unit 55B	passive
TAA 16	Lower Beckler River	bull thistle	6050600144	Beckler Thin Unit 55B	passive
TAA 16	Lower Beckler River	bull thistle	6050600166	Beckler Thin Unit 51	passive
TAA 16	Lower Beckler River	herb Robert	6050600167	Beckler Thin Unit 51	passive
TAA 16	Lower Beckler River	herb Robert	6050600168	Beckler Thin Unit 51	passive
TAA 16	Lower Beckler River	bull thistle	6050600178	Beckler Thin Unit 51	passive
TAA 16	Lower Beckler River	spotted knapweed	6050600202	Road 6514	passive
TAA 16	Lower Beckler River	Bohemian knotweed	06-KW-014	Rd 6522 @ Johnson Creek	passive
TAA 16	Lower Beckler River	herb Robert	06-KW-020	Rd 6500-104 stockpile	None
TAA 16	Lower Beckler River	Canada thistle	06-KW-021	Rd 6500-104 stockpile	None
TAA 16	Lower Beckler River	bull thistle	06-KW-022	Rd 6500-104 stockpile	None
TAA 16	Lower Beckler River	spotted knapweed	06-KW-025	Road 6520	passive
TAA 16	Lower Beckler River	herb Robert	6050600059	Sky-Beckler Thin Unit 55	passive
TAA 16	Lower Beckler River	herb Robert	6050600162	Beckler Thin Unit 51	passive
TAA 16	Lower Beckler River	tansy ragwort	06-KW-011	Road 65, milepost 5.3	passive
TAA 16	Lower Beckler River	herb Robert	6050600140	Beckler Thin Unit 55A	passive
TAA 16	Lower Beckler River	bull thistle	6050600165	Beckler Thin Unit 51	passive
TAA 16	Lower Beckler River	herb Robert	06-KW-012	Beckler River Rd, first 3 miles	passive
TAA 16	Lower Beckler River	spotted knapweed	06-LP-030	Rd 6514	passive
TAA 16	Lower Beckler River	Scotch broom	06-LP-031	Rd 6512-105 (Sky Forks sale)	passive
TAA 16	Lower Beckler River	Scotch broom	06-LP-033	REVISIT to Road 6520	passive
TAA 16	Lower Beckler River	bull thistle	06-SJ-004	Road 6516-510 decom	passive
TAA 16	Lower Beckler River	bull thistle	06-SJ-005	Road 6512-210 decom	passive
TAA 16	Lower Beckler River	bull thistle	06-SJ-006	Road 6512	passive

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
TAA 16	Lower Beckler River	wild carrot	06-SJ-007	Road 6512	passive
TAA 16	Lower Beckler River	Bohemian knotweed	06-SS-050	Beckler Rd, 500' up	passive
TAA 16	Lower Beckler River	orange hawkweed	06-SS-051	Beckler Rd, Bolt Ck crossing	Seed and Mulch
TAA 16	Lower Beckler River	sulphur cinquefoil	06-SS-068	Beckler River Road 6500	passive
TAA 16	Lower Beckler River	Bohemian knotweed	06-TF-001	Hwy 2, Rd 6500 jct (Sky Forks sale)	passive
TAA 16	Lower Beckler River	Bohemian knotweed	06-TF-002	Rd 6500 milepost 3.6 (revisit)	passive
TAA 17	Upper Beckler River	common tansy	6050600025	Sky-Beckler Thin Unit 5	passive
TAA 17	Upper Beckler River	Scotch broom	6050600026	Sky-Beckler Thin Unit 5	passive
TAA 17	Upper Beckler River	bull thistle	6050600145	Beckler Thin Unit 69	passive
TAA 17	Upper Beckler River	bull thistle	6050600146	Beckler Thin Unit 69	passive
TAA 17	Upper Beckler River	bull thistle	6050600147	Beckler Thin Unit 69	passive
TAA 17	Upper Beckler River	bull thistle	6050600148	Beckler Thin Unit 69	passive
TAA 17	Upper Beckler River	Canada thistle	6050600149	Beckler Thin Unit 69	passive
TAA 17	Upper Beckler River	Canada thistle	6050600150	Beckler Thin Unit 69	passive
TAA 17	Upper Beckler River	Canada thistle	6050600151	Beckler Thin Unit 69	passive
TAA 17	Upper Beckler River	Canada thistle	6050600152	Beckler Thin Unit 7	passive
TAA 17	Upper Beckler River	Canada thistle	6050600153	Beckler Thin Unit 7	passive
TAA 17	Upper Beckler River	Canada thistle	6050600154	Beckler Thin Unit 10	passive
TAA 17	Upper Beckler River	Canada thistle	6050600155	Beckler Thin Unit 10	passive
TAA 17	Upper Beckler River	bull thistle	6050600156	Beckler Thin Unit 10	passive
TAA 17	Upper Beckler River	Canada thistle	6050600157	Beckler Thin Unit 19	passive
TAA 17	Upper Beckler River	Canada thistle	6050600158	Beckler Thin Unit 19	passive
TAA 17	Upper Beckler River	Canada thistle	6050600159	Beckler Thin Unit 19	passive
TAA 17	Upper Beckler River	Canada thistle	6050600160	Beckler Thin Unit 19	passive
TAA 17	Upper Beckler River	bull thistle	6050600161	Beckler Thin Unit 27	passive
TAA 17	Upper Beckler River	Himalayan blackberry	6050600163	Beckler Thin Unit 30	passive
TAA 17	Upper Beckler River	Canada thistle	6050600164	Beckler Thin Unit 30	passive
TAA 17	Upper Beckler River	orange hawkweed	06-KW-017	Rd 65, milepost 10.9	passive
TAA 17	Upper Beckler River	sulphur cinquefoil	06-KW-018	Rd 65, milepost 11.0	passive
TAA 17	Upper Beckler River	yellow hawkweed	06-KW-019	Rd 6550-610 stockpile	None
TAA 17	Upper Beckler River	orange hawkweed	06-KW-024	Rd 65, milepost 11.0	passive
TAA 17	Upper Beckler River	Scotch broom	06-SJ-002	Road 6560 decomm	passive
TAA 18	Rapid River	herb Robert	6050600162	Beckler Thin Unit 51	passive
TAA 18	Rapid River	orange hawkweed	06-SJ-003	Road 6530	passive

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
TAA 19	North Fork Skykomish River	common tansy	6050600012	Sky Forks Thin, Rd 6334 MP 2.8	passive
TAA 19	North Fork Skykomish River	common tansy	6050600025	Sky-Beckler Thin Unit 5	passive
TAA 19	North Fork Skykomish River	bird's foot trefoil	6050600039	North Fork Skykomish Trail #1051	None
TAA 19	North Fork Skykomish River	hairy cat's ear	6050600040	North Fork Skykomish Trail #1051	None
TAA 19	North Fork Skykomish River	oxeye daisy	6050600041	North Fork Skykomish Trail #1051	None
TAA 19	North Fork Skykomish River	bull thistle	6050600043	North Fork Skykomish Trail 1051	None
TAA 19	North Fork Skykomish River	common tansy	6050600044	North Fork Skykomish Trail 1051	None
TAA 19	North Fork Skykomish River	spotted hawkweed	6050600125	Road 6300 east of San Juan campground	Seed and Mulch
TAA 19	North Fork Skykomish River	common hawkweed	6050600179	6330 rd	passive
TAA 19	North Fork Skykomish River	herb Robert	06-KW-007	San Juan Campground	passive
TAA 19	North Fork Skykomish River	herb Robert	06-KW-009	Troublesome Ck Campground	passive
TAA 19	North Fork Skykomish River	orange hawkweed	06-KW-013	Rd 63, milepost 2.1	passive
TAA 19	North Fork Skykomish River	yellow hawkweed	06-KW-019	Rd 6550-610 stockpile	None
TAA 19	North Fork Skykomish River	Bohemian knotweed	06-KW-026	Rd 63, 2.2 mi w of Rd 65	passive
TAA 19	North Fork Skykomish River	diffuse knapweed	06-KW-027	Rd 6334, mile 2.8 (Sky Forks sale)	passive
TAA 19	North Fork Skykomish River	Bohemian knotweed	06-KW-028	Rd 6300-310 spur	passive
TAA 19	North Fork Skykomish River	Bohemian knotweed	06-KW-030	Rd 63, 3.3 mi E of Hwy 2	passive
TAA 19	North Fork Skykomish River	common hawkweed	06-KW-008	Troublesome Ck Campground	passive
TAA 20	Highway 2 Corridor &	English ivy	6050600007	Lowe Creek Rd 6030 @ MP	passive

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
	Miller River			0.3	
TAA 20	Highway 2 Corridor & Miller River	orange hawkweed	6050600032	Maloney Creek	passive
TAA 20	Highway 2 Corridor & Miller River	herb Robert	6050600033	Maloney Creek	passive
TAA 20	Highway 2 Corridor & Miller River	orange hawkweed	6050600034	Lake Serene trailhead	passive
TAA 20	Highway 2 Corridor & Miller River	jewelweed	6050600035	Lake Serene Trail	passive
TAA 20	Highway 2 Corridor & Miller River	herb Robert	6050600042	Cable Drop Trail Repair	passive
TAA 20	Highway 2 Corridor & Miller River	herb Robert	6050600071	Sky-Beckler Thin Unit 63	passive
TAA 20	Highway 2 Corridor & Miller River	herb Robert	6050600073	Sky-Beckler Thin Unit 63	passive
TAA 20	Highway 2 Corridor & Miller River	Scotch broom	6050600074	Sky-Beckler Thin Unit 63	passive
TAA 20	Highway 2 Corridor & Miller River	orange hawkweed	6050600134	Skykomish Boneyard	None
TAA 20	Highway 2 Corridor & Miller River	herb Robert	6050600140	Beckler Thin Unit 55A	passive
TAA 20	Highway 2 Corridor & Miller River	herb Robert	6050600196	Road 6410	passive
TAA 20	Highway 2 Corridor & Miller River	herb Robert	6050600198	Road 6028	passive
TAA 20	Highway 2 Corridor & Miller River	tansy ragwort	6050600199	Road 6028 @ MP 0.3	passive
TAA 20	Highway 2 Corridor & Miller River	herb Robert	6050600200	Road 6000-267	passive
TAA 20	Highway 2 Corridor & Miller River	herb Robert	6050600201	Road 6066-060	passive
TAA 20	Highway 2 Corridor & Miller River	herb Robert	6050600204	Road 68	passive
TAA 20	Highway 2 Corridor & Miller River	English holly	6050600205	Road 6000-267	passive
TAA 20	Highway 2 Corridor & Miller River	herb Robert	6050600206	Road 6024-102	passive

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
TAA 20	Highway 2 Corridor & Miller River	smooth hawkweed	06-AR-084	Hwy 2; m.p. 38-39	passive
TAA 20	Highway 2 Corridor & Miller River	yellow hawkweed	06-AR-085	Road 6066/6067	Seed and Mulch
TAA 20	Highway 2 Corridor & Miller River	Bohemian knotweed	06-DK-001	Old Cascade Hwy, w of RR Track	passive
TAA 20	Highway 2 Corridor & Miller River	orange hawkweed	06-DL-001	end of Thelma Street	None
TAA 20	Highway 2 Corridor & Miller River	herb Robert	06-KW-001	Lowe Creek Road	passive
TAA 20	Highway 2 Corridor & Miller River	Bohemian knotweed	06-KW-005	Skykomish River	Plant rooted stock
TAA 20	Highway 2 Corridor & Miller River	tansy ragwort	06-KW-006	BPA right-of-way	passive
TAA 20	Highway 2 Corridor & Miller River	herb Robert	06-KW-012	Beckler River Rd, first 3 miles	passive
TAA 20	Highway 2 Corridor & Miller River	Bohemian knotweed	06-KW-015	Skykomish River, mile 48	Plant rooted stock
TAA 20	Highway 2 Corridor & Miller River	Bohemian knotweed	06-KW-016	Miller River	Plant rooted stock
TAA 20	Highway 2 Corridor & Miller River	tansy ragwort	06-KW-029	Rd 6022, no-name spur	passive
TAA 20	Highway 2 Corridor & Miller River	Bohemian knotweed	06-KW-031	Rd 6020, entry to Mt Index riversites	passive
TAA 20	Highway 2 Corridor & Miller River	Bohemian knotweed	06-KW-032	Rd 6020, jct w Hwy 2	passive
TAA 20	Highway 2 Corridor & Miller River	butterfly bush	06-KW-033	Rd 6022, 3.0 mi from Rd 63	passive
TAA 20	Highway 2 Corridor & Miller River	tansy ragwort	06-KW-034	Rd 6020 powerline, 4 mi from Rd 63	passive
TAA 20	Highway 2 Corridor & Miller River	orange hawkweed	06-LP-019	Skykomish District Office	None
TAA 20	Highway 2 Corridor & Miller River	Scotch broom	06-LP-031	Rd 6512-105 (Sky Forks sale)	passive
TAA 20	Highway 2 Corridor & Miller River	herb Robert	06-LP-034	SkyForks timbersale	passive
TAA 20	Highway 2 Corridor &	herb Robert	06-LP-036	Apex Mill	passive

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
	Miller River				
TAA 20	Highway 2 Corridor & Miller River	Canada thistle	06-LP-037	Rd 6512-015 (Sky Forks sale)	passive
TAA 20	Highway 2 Corridor & Miller River	herb Robert	06-SJ-008	Berschinski driveway	passive
TAA 20	Highway 2 Corridor & Miller River	Bohemian knotweed	06-SJ-009	Berschinski driveway	passive
TAA 20	Highway 2 Corridor & Miller River	herb Robert	06-SJ-011	Hwy 2 stabilization milepost 46	passive
TAA 20	Highway 2 Corridor & Miller River	herb Robert	06-SJ-012	Hwy 2 stabilization stream bridge	passive
TAA 20	Highway 2 Corridor & Miller River	Bohemian knotweed	06-SS-050	Beckler Rd, 500' up	passive
TAA 20	Highway 2 Corridor & Miller River	herb Robert	06-TD-044	Baring; Rd 6028 MP 0.5	passive
TAA 20	Highway 2 Corridor & Miller River	herb Robert	06-TD-045	Miller River Rd 6410, 1/4 mile up	passive
TAA 20	Highway 2 Corridor & Miller River	Bohemian knotweed	06-TD-046	Lake Serene Trail	passive
TAA 20	Highway 2 Corridor & Miller River	Bohemian knotweed	06-TF-001	Hwy 2, Rd 6500 jct (Sky Forks sale)	passive
TAA 20	Highway 2 Corridor & Miller River	Bohemian knotweed	06-TF-060	Money Creek Campground	Plant rooted stock
TAA 20	Highway 2 Corridor & Miller River	herb Robert	06-TF-061	Money Creek Campground	passive
TAA 20	Highway 2 Corridor & Miller River	yellow archangel	06-TF-062	Skykomish District Office	Plant rooted stock
TAA 20	Highway 2 Corridor & Miller River	dalmatian toadflax	06-VW-081	Hwy 2 near Canyon falls	passive
TAA 20	Highway 2 Corridor & Miller River	giant knotweed	06-VW-082	Mt Index Road 6020-10	passive
TAA 21	Money Creek	Bohemian knotweed	6050600020	Money Cr Rd 6420 2.3 miles E of Lk Elizabeth	passive
TAA 21	Money Creek	Bohemian knotweed	6050600194	Road 6420 @ MP 1.1	passive
TAA 21	Money Creek	butterfly bush	6050600195	Road 6420 @ MP 0.7	passive
TAA 21	Money Creek	herb Robert	6050600197	Road 6420	passive
TAA 21	Money Creek	Bohemian knotweed	06-RB-001	Rd 6420, milepost 4.3	passive

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
TAA 22	Sultan River	reed canarygrass	6050600013	Jackson relicensing, Stringer bridge	Seed and Mulch
TAA 22	Sultan River	cutleaf blackberry	6050600014	Jackson relicensing, Stringer bridge	passive
TAA 22	Sultan River	Canada thistle	6050600015	Jackson relicensing, Stringer bridge	passive
TAA 22	Sultan River	herb Robert	6050600016	Jackson relicensing, Stringer bridge	passive
TAA 22	Sultan River	bull thistle	6050600017	Jackson relicensing, Stringer bridge	passive
TAA 22	Sultan River	Himalayan blackberry	06-AR-073	Jackson relicensing Road 6122, second clearing	passive
TAA 22	Sultan River	Canada thistle	06-AR-074	Jackson relicensing Road 6122, second clearing	passive
TAA 22	Sultan River	oxeye daisy	06-AR-076	Jackson relicensing Road 6122, second clearing	passive
TAA 22	Sultan River	Canada thistle	06-AR-079	Jackson relicensing Road 6122, first clearing	passive
TAA 22	Sultan River	Scotch broom	06-AR-082	Jackson relicensing Road 6122, first clearing	passive
TAA 22	Sultan River	cutleaf blackberry	06-AR-083	Jackson relicensing Road 6122, first clearing	Seed and Mulch
TAA 22	Sultan River	Canada thistle	06-AR-088	Jackson relicensing, Rd 6122 river access trail	passive
TAA 22	Sultan River	cutleaf blackberry	06-AR-089	Jackson relicensing, Rd 6122 river access trail	Seed and Mulch
TAA 23	South Fork Stillaguamish River	herb Robert	6050200052	Hemple Creek picnic area	passive
TAA 23	South Fork Stillaguamish River	Bohemian knotweed	6050200056	Mt Loop Hwy, 1.1 miles east of Gold Basin CG	passive
TAA 23	South Fork Stillaguamish River	common hawkweed	6050200057	Verlot PSC	Seed and Mulch
TAA 23	South Fork Stillaguamish River	common periwinkle	6050200124	Camp Silverton	Seed and Mulch
TAA 23	South Fork Stillaguamish River	yellow archangel	6050200130	Road 4020	passive
TAA 23	South Fork	common hawkweed	6050200131	Road 4020	Seed and Mulch

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
	Stillaguamish River				
TAA 23	South Fork Stillaguamish River	common hawkweed	6050200132	Road 41 @ MP 13.3	passive
TAA 23	South Fork Stillaguamish River	common hawkweed	6050200133	Road 41	Seed and Mulch
TAA 23	South Fork Stillaguamish River	meadow hawkweed	6050200134	Rd 41 MP 11.9	passive
TAA 23	South Fork Stillaguamish River	meadow hawkweed	6050200135	Rd 41 MP 13.2 to the end	Seed and Mulch
TAA 23	South Fork Stillaguamish River	meadow hawkweed	6050200137	Rd 41 MP 12.9	passive
TAA 23	South Fork Stillaguamish River	orange hawkweed	6050200138	Rd 41 MP 11.7	passive
TAA 23	South Fork Stillaguamish River	meadow hawkweed	6050200139	Rd 41 MP 11.4	passive
TAA 23	South Fork Stillaguamish River	herb Robert	6050200201	Mt. Pilchuck Road @ MP 0.5	passive
TAA 23	South Fork Stillaguamish River	herb Robert	02-AR-003	Dick Sperry Picnic Site	passive
TAA 23	South Fork Stillaguamish River	herb Robert	02-AR-004	Coal Creek CG	passive
TAA 23	South Fork Stillaguamish River	herb Robert	02-AR-006	Red Bridge CG	passive
TAA 23	South Fork Stillaguamish River	herb Robert	02-AR-007	Tulalip Mill CG	passive
TAA 23	South Fork Stillaguamish River	Bohemian knotweed	02-AR-029	Mountain Loop E of Wiley Ck	passive
TAA 23	South Fork Stillaguamish River	Bohemian knotweed	02-AR-033	Schweitzer 2: Rd 4020 Rockpit	None
TAA 23	South Fork Stillaguamish River	policeman's helmet	02-AR-036	Road 41 @ MP 13.1-13.4	passive
TAA 23	South Fork Stillaguamish River	herb Robert	02-AR-042	Verlot PSC boneyard	None
TAA 23	South Fork Stillaguamish River	Bohemian knotweed	02-AR-047	Boardman Lake Trailhead	passive
TAA 23	South Fork Stillaguamish River	Bohemian knotweed	02-LP-016	Mt. Pilchuck Rd, Mile 2.1&2.2 (revisit)	passive

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
TAA 23	South Fork Stillaguamish River	Bohemian knotweed	02-LP-017	Schweitzer Ck Rd 4021 (revisit)	passive
TAA 23	South Fork Stillaguamish River	Bohemian knotweed	02-LP-018	The Sinkhole	passive
TAA 23	South Fork Stillaguamish River	herb Robert	02-LP-057	River Road 4037	passive
TAA 23	South Fork Stillaguamish River	orange hawkweed	6050200045	Big 4 culvert	passive
TAA 23	South Fork Stillaguamish River	common hawkweed	6050200051	Mt. Loop Hwy from Dick Sperry to Barlow Pass	Seed and Mulch
TAA 23	South Fork Stillaguamish River	orange hawkweed	02-LP-004	Mtn Loop Hwy btwn Perry and Martin Cks	Seed and Mulch
TAA 23	South Fork Stillaguamish River	common hawkweed	6050200044	Buck Creek Br (Mt. Loop Hwy)	passive
TAA 24	Fall Creek	Scotch broom	02-AR-041	Road 2083 @ MP 0.5	passive
TAA 24	Fall Creek	tansy ragwort	02-KW-002	Road 2083	passive
TAA 24	Fall Creek	Bohemian knotweed	02-LB-005	Sauk Floodplain (TNC patch A141)	Plant rooted stock
TAA 24	Fall Creek	spotted knapweed	02-LP-053	Road 2083	passive
TAA 24	Fall Creek	Japanese knotweed	02-LP-059	Upper River Sauk Corridor	passive
TAA 25	Sauk-Whitechuck Confluence	Bohemian knotweed	02-LB-008	Road 2200-013	passive
TAA 26	White Chuck River Road 23	herb Robert	6050200126	Whitechuck Bench Trail	passive
TAA 26	White Chuck River Road 23	orange hawkweed	02-AR-018	Whitechuck Road #23	passive
TAA 26	White Chuck River Road 23	tansy ragwort	02-KW-012	Road 23	passive
TAA 26	White Chuck River Road 23	herb Robert	02-KW-013	Road 2311	passive
TAA 26	White Chuck River Road 23	herb Robert	6050200043	Whitechuck Rd 23 from MP 0 to 3.4	passive
TAA 27	Darrington South	orange hawkweed	6050200191	Road 2420 #3	passive
TAA 27	Darrington South	orange hawkweed	02-AR-002	Roads 2070, 2073	passive
TAA 27	Darrington South	orange hawkweed	02-AR-005	Road 2060	passive
TAA 27	Darrington South	herb Robert	02-AR-026	Gold Hill ERFO	passive
TAA 27	Darrington South	Bohemian knotweed	02-KW-008	Gold Hill Road 24	passive

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
TAA 27	Darrington South	orange hawkweed	02-LP-003	Mtn Loop Hwy near Darrington	Seed and Mulch
TAA 27	Darrington South	Japanese knotweed	02-LP-059	Upper River Sauk Corridor	passive
TAA 28	Squire Creek	Bohemian knotweed	02-AR-030	Squire Ck Rd 2040	passive
TAA 29	Sauk Prairie	hedge false bindweed	6050200053	Road 24 @ MP 0.3	passive
TAA 29	Sauk Prairie	Scotch broom	6050200140	Queensgate	passive
TAA 29	Sauk Prairie	cutleaf blackberry	6050200141	Queensgate	passive
TAA 29	Sauk Prairie	cutleaf blackberry	6050200142	Queensgate	passive
TAA 29	Sauk Prairie	sulphur cinquefoil	6050200143	Queensgate	passive
TAA 29	Sauk Prairie	cutleaf blackberry	6050200144	Queensgate	passive
TAA 29	Sauk Prairie	cutleaf blackberry	6050200145	Queensgate	passive
TAA 29	Sauk Prairie	herb Robert	6050200146	Queensgate	passive
TAA 29	Sauk Prairie	Canada thistle	6050200147	Queensgate	passive
TAA 29	Sauk Prairie	herb Robert	6050200148	Queensgate	passive
TAA 29	Sauk Prairie	herb Robert	6050200155	Suiattle Road 26	Seed and Mulch
TAA 29	Sauk Prairie	cutleaf blackberry	6050200161	Queensgate	passive
TAA 29	Sauk Prairie	yellow archangel	6050200194	Road 24 @ MP 0.3	passive
TAA 29	Sauk Prairie	cutleaf blackberry	02-AR-027	Dan Creek Horse Pasture	passive
TAA 29	Sauk Prairie	Canada thistle	02-AR-028	Dan Creek Horse Pasture	passive
TAA 29	Sauk Prairie	tansy ragwort	02-AR-031	Dan Creek Rd 24 mile 0.3	passive
TAA 29	Sauk Prairie	Bohemian knotweed	02-AR-040	Road 24 @ MP0.1	passive
TAA 29	Sauk Prairie	herb Robert	02-AR-048	Dan Creek Horse Pasture	passive
TAA 29	Sauk Prairie	orange hawkweed	6050200046	DRD bunkhouse lawn	None
TAA 29	Sauk Prairie	sulphur cinquefoil	6050200047	Dan Creek horse pasture	passive
TAA 29	Sauk Prairie	Bohemian knotweed	6050200048	Dan Creek Rd 24 @ MP 0.3	passive
TAA 30	Dan Creek	meadow hawkweed	6050200055	Road 2435 @ MP 6.1	passive
TAA 30	Dan Creek	orange hawkweed	6050200206	Road 2435 @ MP 2.7	passive
TAA 30	Dan Creek	meadow hawkweed	6050200207	Road 2435 MP 3.1	passive
TAA 30	Dan Creek	orange hawkweed	02-AR-032	Rd 2435 #2	passive
TAA 30	Dan Creek	orange hawkweed	02-LP-029	Conn Ck, Rd 2435	Seed and Mulch
TAA 30	Dan Creek	herb Robert	02-LP-054	Decline Thin herb Robert	passive
TAA 30	Dan Creek	tansy ragwort	02-LP-055	Decline Thin tansy	passive
TAA 30	Dan Creek	Canada thistle	02-SJ-001	Decline Ck drainage	passive
TAA 30	Dan Creek	Canada thistle	02-SJ-002	Decline Ck drainage	passive
TAA 30	Dan Creek	Canada thistle	02-SJ-003	Decline Ck drainage	passive
TAA 30	Dan Creek	Canada thistle	02-SJ-004	Decline Ck drainage	passive

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
TAA 30	Dan Creek	bull thistle	02-SJ-005	Decline Ck drainage	passive
TAA 30	Dan Creek	herb Robert	02-SJ-006	Decline Ck drainage	passive
TAA 30	Dan Creek	bull thistle	02-SJ-007	Decline Ck drainage	passive
TAA 30	Dan Creek	Canada thistle	02-SJ-008	Decline Ck drainage	passive
TAA 30	Dan Creek	herb Robert	02-SJ-009	Decline Ck drainage	passive
TAA 30	Dan Creek	Canada thistle	02-SJ-010	Decline Ck drainage	passive
TAA 30	Dan Creek	Canada thistle	02-SJ-011	Decline Ck drainage	passive
TAA 30	Dan Creek	bull thistle	02-SJ-012	Decline Ck drainage	passive
TAA 31	Prairie Mountain	herb Robert	02-AR-008	Road 2141	passive
TAA 31	Prairie Mountain	herb Robert	02-AR-009	Road 2140 north	passive
TAA 31	Prairie Mountain	herb Robert	02-AR-010	Road 2140 south	passive
TAA 31	Prairie Mountain	Canada thistle	02-AR-011	Road 2140-014	passive
TAA 31	Prairie Mountain	Canada thistle	02-AR-012	Road 2140 south	passive
TAA 31	Prairie Mountain	Canada thistle	02-AR-013	Road 2140 north	passive
TAA 31	Prairie Mountain	tansy ragwort	02-AR-014	Road 2141 tansy	passive
TAA 31	Prairie Mountain	tansy ragwort	02-AR-015	Road 2140 east tansy	passive
TAA 31	Prairie Mountain	tansy ragwort	02-AR-016	Road 2140 west tansy	passive
TAA 31	Prairie Mountain	tansy ragwort	02-AR-017	Road 2140-020	passive
TAA 31	Prairie Mountain	tansy ragwort	02-AR-043	Road 2430 past the road end	passive
TAA 31	Prairie Mountain	orange hawkweed	02-AR-044	Road 2430 past the road end	passive
TAA 31	Prairie Mountain	meadow hawkweed	02-AR-045	Road 2430 past the road end	passive
TAA 31	Prairie Mountain	Canada thistle	02-AR-046	Road 2430 past the road end	passive
TAA 32	Circle Creek-Suiattle River	Scotch broom	6050200149	Green Mountain horse pasture	passive
TAA 32	Circle Creek-Suiattle River	common burdock	6050200150	Green Mountain horse pasture	passive
TAA 32	Circle Creek-Suiattle River	common tansy	6050200153	Green Mountain horse pasture	Seed and Mulch
TAA 32	Circle Creek-Suiattle River	herb Robert	6050200154	South Suiattle Road 25	passive
TAA 32	Circle Creek-Suiattle River	herb Robert	6050200155	Suiattle Road 26	Seed and Mulch
TAA 32	Circle Creek-Suiattle	herb Robert	6050200163	Rd 27 from MP 0.0 to 1.8	passive

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
	River				
TAA 32	Circle Creek-Suiattle River	Canada thistle	6050200173	Road 2703 @ MP 0.7	passive
TAA 32	Circle Creek-Suiattle River	orange hawkweed	6050200176	Road 2703 @ MP 4.0	passive
TAA 32	Circle Creek-Suiattle River	orange hawkweed	6050200177	Road 27 from MP 4.5 to 6.5	Seed and Mulch
TAA 32	Circle Creek-Suiattle River	sulphur cinquefoil	6050200195	Darrington Seed and Mulch Orchard	Seed and Mulch
TAA 32	Circle Creek-Suiattle River	Canada thistle	6050200197	Darrington Seed and Mulch Orchard	Seed and Mulch
TAA 32	Circle Creek-Suiattle River	orange hawkweed	6050200198	Darrington Seed and Mulch Orchard	Seed and Mulch
TAA 32	Circle Creek-Suiattle River	orange hawkweed	02-AR-001	Harriet Creek	passive
TAA 32	Circle Creek-Suiattle River	sulphur cinquefoil	02-AR-019	Green Mountain Horse Pasture	passive
TAA 32	Circle Creek-Suiattle River	herb Robert	02-AR-024	Huckleberry Mountain Trail	passive
TAA 32	Circle Creek-Suiattle River	orange hawkweed	02-KW-003	Suiattle Guard Station	None
TAA 32	Circle Creek-Suiattle River	Scotch broom	02-KW-011	Road 2680	passive
TAA 32	Circle Creek-Suiattle River	Canada thistle	02-LP-028	Green Mountain Horse Pasture	passive
TAA 33	Big Creek-Tenas Creek	Canada thistle	6050200033	Road 2650 west	passive
TAA 33	Big Creek-Tenas Creek	Canada thistle	6050200034	Road 2650 east	passive
TAA 33	Big Creek-Tenas Creek	herb Robert	6050200035	Road 2650	passive
TAA 33	Big Creek-Tenas Creek	Canada thistle	6050200036	Road 2660 west	passive
TAA 33	Big Creek-Tenas Creek	Canada thistle	6050200037	Road 2660 east	passive
TAA 33	Big Creek-Tenas Creek	herb Robert	6050200038	Road 2660	passive
TAA 33	Big Creek-Tenas Creek	orange hawkweed	6050200039	Road 2660	passive
TAA 33	Big Creek-Tenas Creek	herb Robert	6050200154	South Suiattle Road 25	passive
TAA 33	Big Creek-Tenas Creek	herb Robert	6050200155	Suiattle Road 26	Seed and Mulch
TAA 33	Big Creek-Tenas Creek	common tansy	6050200156	All Creek gravel pit	None
TAA 33	Big Creek-Tenas Creek	orange hawkweed	6050200167	Road 25 @ MP 2.45	passive
TAA 33	Big Creek-Tenas Creek	meadow hawkweed	6050200178	Road 26 @ MP 7.6	passive

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
TAA 33	Big Creek-Tenas Creek	orange hawkweed	6050200202	Suiattle Road 26 @ MP 6.0	passive
TAA 33	Big Creek-Tenas Creek	orange hawkweed	6050200203	South Suiattle Road 25 @ MP 2.2	passive
TAA 33	Big Creek-Tenas Creek	orange hawkweed	6050200204	Suiattle Road 26 @ MP 8.5	passive
TAA 33	Big Creek-Tenas Creek	yellow hawkweed	02-AR-025	Grade Creek Road 2642	Seed and Mulch
TAA 33	Big Creek-Tenas Creek	tansy ragwort	02-AR-035	Suiattle Rd 26 near Tenas Ck	passive
TAA 33	Big Creek-Tenas Creek	orange hawkweed	02-AR-039	Road 2642 #2	passive
TAA 33	Big Creek-Tenas Creek	Scotch broom	02-KW-005	Road 2640	passive
TAA 33	Big Creek-Tenas Creek	Scotch broom	02-KW-006	Road 2640	passive
TAA 33	Big Creek-Tenas Creek	orange hawkweed	02-KW-007	Road 2642	passive
TAA 33	Big Creek-Tenas Creek	herb Robert	02-KW-010	Rd 2510	passive
TAA 33	Big Creek-Tenas Creek	tansy ragwort	02-LP-002	Grade Ck Rd 2640 & 2642	passive
TAA 33	Big Creek-Tenas Creek	sulphur cinquefoil	02-LP-027	All Ck gravel pit	None
TAA 33	Big Creek-Tenas Creek	Scotch broom	02-LP-056	All Ck gravel pit	None
TAA 33	Big Creek-Tenas Creek	herb Robert	02-LP-058	All Ck gravel pit	None
TAA 33	Big Creek-Tenas Creek	Scotch broom	6050200040	Road 2661	passive
TAA 33	Big Creek-Tenas Creek	herb Robert	6050200042	Rd 2640 from MP 0 to 1.1 (2.1 now)	Seed and Mulch
TAA 34	Segelson Pass Road 18	common hawkweed	6050200220	Road 1855 @ MP 1.0	passive
TAA 34	Segelson Pass Road 18	yellow hawkweed	01-AR-009	Rd 1750, DeForest Ck	passive
TAA 34	Segelson Pass Road 18	spotted knapweed	01-LP-026	Road 18 near the 025 spur	passive
TAA 34	Segelson Pass Road 18	yellow hawkweed	01-LP-074	Little Deer Peak Rockpit	None
TAA 34	Segelson Pass Road 18	bull thistle	01-LP-075	Little Deer Peak Rockpit	None
TAA 34	Segelson Pass Road 18	yellow hawkweed	02-AR-020	Road 18 milepost 7.7-15	Seed and Mulch
TAA 34	Segelson Pass Road 18	Scotch broom	02-AR-021	Road 1855 Segelson Communication Site	passive
TAA 34	Segelson Pass Road 18	Scotch broom	02-AR-022	Road 18 Segelson Communication Site	passive
TAA 34	Segelson Pass Road 18	Scotch broom	02-AR-037	Road 18 @ MP 8.4 & 8.9	passive
TAA 34	Segelson Pass Road 18	yellow hawkweed	02-AR-038	Road 1855	Seed and Mulch
TAA 34	Segelson Pass Road 18	meadow hawkweed	01-AR-079	Road 17	Seed and Mulch
TAA 34	Segelson Pass Road 18	orange hawkweed	6050200050	Road 18 from MP 3.0 to 3.1	passive
TAA 36	Sedro Woolley	herb Robert	6050100010	Baker River Ranger Station	passive
TAA 36	Sedro Woolley	English holly	6050100011	Baker River Ranger Station	passive
TAA 36	Sedro Woolley	common periwinkle	6050100012	Baker River Ranger Station	plant rooted stock
TAA 36	Sedro Woolley	Himalayan blackberry	6050100025	Kaaland Property	plant rooted stock

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
TAA 36	Sedro Woolley	butterfly bush	6050100133	Kaaland Property	plant rooted stock
TAA 36	Sedro Woolley	Scotch broom	6050100135	Kaaland Property	passive
TAA 36	Sedro Woolley	Bohemian knotweed	6050100136	Kaaland Property	plant rooted stock
TAA 36	Sedro Woolley	common tansy	6050100137	Kaaland Property	Seed and Mulch
TAA 36	Sedro Woolley	common teasel	6050100138	Kaaland Property	passive
TAA 36	Sedro Woolley	Canada thistle	6050100139	Kaaland Property	Seed and Mulch
TAA 36	Sedro Woolley	poison hemlock	6050100140	Kaaland Property	Plant rooted stock
TAA 36	Sedro Woolley	bittersweet nightshade	6050100141	Kaaland Property	Plant rooted stock
TAA 36	Sedro Woolley	common burdock	6050100142	Kaaland Property	passive
TAA 36	Sedro Woolley	reed canarygrass	6050100143	Kaaland Property	Seed and Mulch
TAA 36	Sedro Woolley	Himalayan blackberry	01-AR-005	Skiyou Island north perimeter	Plant rooted stock
TAA 36	Sedro Woolley	Bohemian knotweed	01-AR-013	Skiyou Island southwest corner	passive
TAA 36	Sedro Woolley	Bohemian knotweed	01-AR-014	Deadman Island	passive
TAA 36	Sedro Woolley	Bohemian knotweed	01-AR-015	Giligan Island	Plant rooted stock
TAA 36	Sedro Woolley	Bohemian knotweed	01-AR-046	Kaaland acquisition	Plant rooted stock
TAA 36	Sedro Woolley	butterfly bush	01-AR-061	Skiyou Island southwest corner	Plant rooted stock
TAA 36	Sedro Woolley	Canada thistle	01-AR-062	Skiyou Island, whole thing	Seed and Mulch
TAA 36	Sedro Woolley	common tansy	01-AR-081	Skiyou Island	Seed and Mulch
TAA 36	Sedro Woolley	tansy ragwort	01-AR-082	Skiyou Island	passive
TAA 36	Sedro Woolley	yellow hawkweed	01-LP-024	Iron Mtn sec 30	passive
TAA 36	Sedro Woolley	yellow hawkweed	01-LP-025	Iron Mtn sec 32	passive
TAA 37	Crevice Creek	yellow hawkweed	02-AR-023	Road 28	passive
TAA 38	Finney Creek	butterfly bush	6050100130	Road 17 @ MP 4.75	passive
TAA 38	Finney Creek	yellow hawkweed	01-AR-010	Rd 18 near Rd 17	passive
TAA 38	Finney Creek	yellow hawkweed	01-LP-071	1715-011 Pit	None
TAA 38	Finney Creek	yellow hawkweed	01-LP-072	1722 Pit	None
TAA 38	Finney Creek	yellow hawkweed	01-LP-073	Finney Flat Pit	None
TAA 38	Finney Creek	yellow hawkweed	02-AR-020	Road 18 milepost 7.7-15	Seed and Mulch
TAA 38	Finney Creek	meadow hawkweed	01-AR-079	Road 17	Seed and Mulch
TAA 38	Finney Creek	herb Robert	01-AR-080	Road 17 from MP 0.0 to 13	Seed and Mulch
TAA 39	South of Rockport	yellow flag iris	6050100015	W&SR acquisition, Shaffer property	passive
TAA 39	South of Rockport	common comfrey	6050100028	W&SR acquisition, Shaffer property	passive

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
TAA 39	South of Rockport	Canada thistle	01-AR-041	W&S acquisition - Shaffer property	Seed and Mulch
TAA 39	South of Rockport	cutleaf blackberry	01-AR-087	W&SR acquisition - Schaffer property	passive
TAA 39	South of Rockport	bull thistle	01-AR-088	W&SR acquisition - Schaffer property	passive
TAA 40	Concrete to Rockport	Bohemian knotweed	6050100019	W&SR acquisition, Ovenell property	plant rooted stock
TAA 40	Concrete to Rockport	Himalayan blackberry	6050100021	W&SR acquisition, Ovenell property	planted
TAA 40	Concrete to Rockport	Himalayan blackberry	6050100023	W&SR acquisition, Larsen memorial	plant rooted stock
TAA 40	Concrete to Rockport	tansy ragwort	6050100027	Sauk Mtn Road 1030	seed and mulch
TAA 40	Concrete to Rockport	herb Robert	6050100126	Illabot Rd 16 @ MP 15.4	passive
TAA 40	Concrete to Rockport	orange hawkweed	6050100127	Illabot Rd 16 @ MP 12.5	passive
TAA 40	Concrete to Rockport	meadow hawkweed	6050100128	Illabot Rd 16 @ MP 15.0	passive
TAA 40	Concrete to Rockport	tansy ragwort	6050100129	Road 17 @ MP 0.45	passive
TAA 40	Concrete to Rockport	butterfly bush	6050100132	Illabot Rd 16 MP 11.9	passive
TAA 40	Concrete to Rockport	Canada thistle	01-AR-007	Ovenell property W&S river acquisition	Seed and Mulch
TAA 40	Concrete to Rockport	Bohemian knotweed	01-AR-012	Larsen Memorial	Seed and Mulch
TAA 40	Concrete to Rockport	Canada thistle	01-AR-059	Illabot Creek Rd #16	passive
TAA 40	Concrete to Rockport	bull thistle	01-AR-060	Illabot Creek Rd #16	passive
TAA 40	Concrete to Rockport	herb Robert	01-AR-080	Road 17 from MP 0.0 to 13	Seed and Mulch
TAA 40	Concrete to Rockport	common tansy	01-AR-085	W&S acquisition - Ovenell property	Plant rooted stock
TAA 40	Concrete to Rockport	bull thistle	01-AR-086	W&SR acquisition - Ovenell property	planted
TAA 41	Suiattle Mountain	Canada thistle	01-AR-059	Illabot Creek Rd #16	passive
TAA 41	Suiattle Mountain	bull thistle	01-AR-060	Illabot Creek Rd #16	passive
TAA 41	Suiattle Mountain	orange hawkweed	01-LP-011	Suiattle Mountain area	passive
TAA 43	Baker Lake	giant knotweed	6050100016	Road 12 @ MP 3.95	passive
TAA 43	Baker Lake	herb Robert	6050100118	Rd 11/Rd 1106 junction	passive
TAA 43	Baker Lake	butterfly bush	6050100119	Rd 11/Rd 1106 junction	passive
TAA 43	Baker Lake	wild carrot	6050100120	Rd 11/Rd 1106 junction	passive
TAA 43	Baker Lake	Canada thistle	6050100121	Rd 11/Rd 1106 junction	passive
TAA 43	Baker Lake	common tansy	6050100122	Rd 11/Rd 1106 junction	passive

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
TAA 43	Baker Lake	black locust	6050100123	Baker Lake Resort	passive
TAA 43	Baker Lake	herb Robert	6050100124	Baker Lake Resort	passive
TAA 43	Baker Lake	tansy ragwort	01-AR-003	Baker L - West Bluff of Anderson Point	passive
TAA 43	Baker Lake	tansy ragwort	01-AR-053	Bkr Lake Rd at Forest boundary	passive
TAA 43	Baker Lake	spotted knapweed	01-AR-071	Baker Lake Road @ MP 0.9	passive
TAA 43	Baker Lake	sulphur cinquefoil	01-AR-073	Koma Kulshan Guard Station	passive
TAA 43	Baker Lake	Canada thistle	01-AR-074	Koma Kulshan Guard Station	passive
TAA 43	Baker Lake	bull thistle	01-JA-001	Baker Lake Road/Panorama Pt CG	passive
TAA 43	Baker Lake	bull thistle	01-JA-002	Baker Lake Road	passive
TAA 43	Baker Lake	bull thistle	01-JA-003	Baker Lake Road	passive
TAA 43	Baker Lake	bull thistle	01-JA-004	Baker Lake Road	passive
TAA 43	Baker Lake	hawkweed non-native	01-KB-001	Baker Lake Road, int w Rd 1114	passive
TAA 43	Baker Lake	Bohemian knotweed	01-KB-002	Baker Lake Road, north of Rd 1122	passive
TAA 43	Baker Lake	herb Robert	01-KB-003	Baker Lake Road	passive
TAA 43	Baker Lake	tansy ragwort	01-KB-004	Baker Lake Road/Road 1118	passive
TAA 43	Baker Lake	Japanese knotweed	01-LP-012	Baker Lake Rd, Little Sandy Ck	passive
TAA 43	Baker Lake	Bohemian knotweed	01-LP-013	Bkr Lk Rd Little Shannon Ck (revisit)	passive
TAA 43	Baker Lake	Canada thistle	01-LP-028	Bkr Hydro: Sulphur Creek	passive
TAA 43	Baker Lake	Canada thistle	01-LP-029	Bkr Hydro: Rocky Creek	passive
TAA 43	Baker Lake	bull thistle	01-LP-031	Bkr Hydro: W of Upper Bkr Dam	passive
TAA 43	Baker Lake	bull thistle	01-LP-032	Bkr Hydro: E of KomoKulshan Guard Stn	passive
TAA 43	Baker Lake	Canada thistle	01-LP-033	Bkr Hydro:NW shore Depression Lk	passive
TAA 43	Baker Lake	bull thistle	01-LP-034	Bkr Hydro:Welker Ck Inlet	passive
TAA 43	Baker Lake	bull thistle	01-LP-035	Bkr Hydro:N of Maple Grove campground	passive

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
TAA 43	Baker Lake	herb Robert	01-LP-036	Bkr Hydro:Chadwick Ck @ Bkr Lk Rd	passive
TAA 43	Baker Lake	herb Robert	01-LP-038	Bkr Hydro:south shore opp Shannon Ck CG	passive
TAA 43	Baker Lake	herb Robert	01-LP-039	Bkr Hydro:south shore	passive
TAA 43	Baker Lake	Canada thistle	01-LP-040	Bkr Hydro:west of spawning beach	passive
TAA 43	Baker Lake	bull thistle	01-LP-041	Bkr Hydro:Bkr River inlet	passive
TAA 43	Baker Lake	Scotch broom	01-LP-042	Bkr Hydro:Park Creek	passive
TAA 43	Baker Lake	Canada thistle	01-LP-043	Bkr Hydro:Swift Creek	passive
TAA 43	Baker Lake	bull thistle	01-LP-044	Bkr Hydro:Park Creek	passive
TAA 43	Baker Lake	bull thistle	01-LP-046	Bkr Hydro:Bkr River inlet	passive
TAA 43	Baker Lake	Canada thistle	01-LP-047	Bkr Hydro:Bkr River inlet	passive
TAA 43	Baker Lake	English ivy	01-LP-048	Bkr Hydro:Bkr River inlet	None
TAA 43	Baker Lake	herb Robert	01-LP-049	Bkr Hydro:Upper Bkr Dam	passive
TAA 43	Baker Lake	herb Robert	01-LP-051	Bkr Hydro:Upper Bkr Dam	passive
TAA 43	Baker Lake	herb Robert	01-LP-052	Bkr Hydro:Upper Bkr Dam	passive
TAA 43	Baker Lake	herb Robert	01-LP-054	Bkr Hydro:Upper Bkr Dam	passive
TAA 43	Baker Lake	tansy ragwort	01-LP-055	Bkr Hydro:SE corner Bkr Lk	passive
TAA 43	Baker Lake	Canada thistle	01-LP-056	Bkr Hydro: Sulphur Creek	passive
TAA 43	Baker Lake	bull thistle	01-LP-057	Bkr Hydro:Bkr Lk Dam Road	passive
TAA 43	Baker Lake	herb Robert	01-LP-058	Bkr Hydro:Chadwick Ck	passive
TAA 43	Baker Lake	bull thistle	01-LP-060	Bkr Hydro:Bkr Lk Dam Road	passive
TAA 43	Baker Lake	bull thistle	01-LP-061	Bkr Hydro:fish tank on Bkr Lk Dam Rd	passive
TAA 43	Baker Lake	bull thistle	01-LP-062	Bkr Hydro: Sulphur Creek	passive
TAA 43	Baker Lake	herb Robert	01-LP-063	Bkr Hydro:Welker Ck by campground	passive
TAA 43	Baker Lake	herb Robert	01-LP-064	Bkr Hydro:Upper Bkr Dam	passive
TAA 43	Baker Lake	Canada thistle	01-LP-066	Bkr Hydro:Bkr River inlet	passive
TAA 43	Baker Lake	Canada thistle	01-LP-067	Bkr Hydro:Bkr Lk Dam Road	passive
TAA 43	Baker Lake	herb Robert	01-LP-076	Bkr Hydro:Maple Grove CG	passive
TAA 43	Baker Lake	Scotch broom	01-LP-079	Bkr Hydro:Baker Lk Dam Rd	passive
TAA 43	Baker Lake	Scotch broom	01-LP-080	Bkr Hydro: Sulphur Creek	passive
TAA 43	Baker Lake	Canada thistle	01-LP-082	Bkr Hydro: near Baker Lk Lodge	passive
TAA 43	Baker Lake	reed canarygrass	01-LP-027	Bkr Hydro: near Bkr River	Seed and Mulch

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
				Inlet	
TAA 43	Baker Lake	Canada thistle	01-JA-006	Baker Lake Road	passive
TAA 44	Glacier Creek Rd 39	Canada thistle	01-AR-011	Glacier Creek Rd 39	passive
TAA 45	Mt. Baker Highway 542	herb Robert	6050100009	Deadhorse Rd pit @ MP 1.5	none
TAA 45	Mt. Baker Highway 542	common comfrey	6050100013	SR542 rockpit @ MP 36.3	none
TAA 45	Mt. Baker Highway 542	orange hawkweed	6050100014	SR 542 across from the Glacier PSC	passive
TAA 45	Mt. Baker Highway 542	yellow archangel	6050100020	Glacier FS house	passive
TAA 45	Mt. Baker Highway 542	hedge false bindweed	6050100022	Glacier FS house	passive
TAA 45	Mt. Baker Highway 542	bull thistle	6050100026	Deadhorse Rd pit @ MP 1.5	none
TAA 45	Mt. Baker Highway 542	orange hawkweed	6050100125	SR542 @ Road 3071	passive
TAA 45	Mt. Baker Highway 542	herb Robert	01-AR-002	Excelsior CG intersection	passive
TAA 45	Mt. Baker Highway 542	elephant ear	01-AR-004	Glacier Rec Residence	Plant rooted stock
TAA 45	Mt. Baker Highway 542	herb Robert	01-AR-006	Excelsior CG	passive
TAA 45	Mt. Baker Highway 542	orange hawkweed	01-AR-008	Glacier Ck Rd 39 milepost 0.4	passive
TAA 45	Mt. Baker Highway 542	herb Robert	01-AR-049	N Fk Nooksack stream gage	passive
TAA 45	Mt. Baker Highway 542	Bohemian knotweed	01-AR-054	Hwy 542/3060 Jct.	passive
TAA 45	Mt. Baker Highway 542	elephant ear	01-AR-055	Glacier Public Service Center	Plant rooted stock
TAA 45	Mt. Baker Highway 542	herb Robert	01-AR-056	Glacier Public Service Center	passive
TAA 45	Mt. Baker Highway 542	orange hawkweed	01-AR-063	Mt Baker Hwy, mile 35.3	passive
TAA 45	Mt. Baker Highway 542	Bohemian knotweed	01-AR-064	USFS residence near Glacier	passive
TAA 45	Mt. Baker Highway 542	English ivy	01-AR-066	Glacier FS house	None
TAA 45	Mt. Baker Highway 542	common periwinkle	01-AR-067	Glacier FS house	passive
TAA 45	Mt. Baker Highway 542	Himalayan blackberry	01-AR-070	Glacier FS house	Plant rooted stock
TAA 45	Mt. Baker Highway 542	Bohemian knotweed	01-AR-072	Glacier FS house, east	passive
TAA 45	Mt. Baker Highway 542	meadow hawkweed	01-AR-075	Miners Quarry (Rd 3700-011 pit)	None
TAA 45	Mt. Baker Highway 542	spotted knapweed	01-AR-076	Miners Quarry (Rd 3700-011 pit)	None
TAA 45	Mt. Baker Highway 542	herb Robert	01-AR-077	SR 542 Rock pit @ MP 36.3	None
TAA 45	Mt. Baker Highway 542	Himalayan blackberry	01-AR-078	SR 542 Rock pit @ MP 36.3	None
TAA 45	Mt. Baker Highway 542	Bohemian knotweed	01-LP-014	Mt Bkr Hwy near Barometer Ck (revisit)	passive

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
TAA 45	Mt. Baker Highway 542	wild carrot	01-LP-068	Miner's Quarry	None
TAA 45	Mt. Baker Highway 542	bull thistle	01-LP-069	Miner's Quarry	None
TAA 45	Mt. Baker Highway 542	bull thistle	01-LP-070	Shuksan Pit	None
TAA 45	Mt. Baker Highway 542	herb Robert	01-AR-001	Douglas Fir CG	passive
TAA 45	Mt. Baker Highway 542	Bohemian knotweed	01-AR-065	North Fork Nooksack River	Plant rooted stock
TAA 45	Mt. Baker Highway 542	tansy ragwort	01-LP-001	Mt Baker Hwy	passive
TAA 46	Canyon Creek	Canada thistle	01-AR-057	Canyon Creek Rd 31	passive
TAA 46	Canyon Creek	orange hawkweed	01-LP-023	Canyon Ck Rd 3140	passive
TAA 47	Monte Cristo Townsite	common hawkweed	6050200123	Monte Cristo townsite	None
TAA 48	South of Dan Creek	English holly	6050200028	Dan Creek Thin Unit 1	passive
TAA 48	South of Dan Creek	herb Robert	6050200029	Dan Creek Thin Unit 1	passive
TAA 48	South of Dan Creek	English holly	6050200030	Dan Creek Thin Unit 3	passive
TAA 48	South of Dan Creek	herb Robert	6050200031	Dan Creek Thin Unit 3	passive
TAA 48	South of Dan Creek	herb Robert	6050200032	Dan Creek Thin Unit 3	passive
TAA 48	South of Dan Creek	orange hawkweed	6050200054	Road 2420 @ MP 3.2	passive
TAA 48	South of Dan Creek	orange hawkweed	6050200189	Road 2420 #2	passive
TAA 49	Tonga Ridge	spotted knapweed	6050600192	Road 6830 @ MP 2.6	passive
TAA 49	Tonga Ridge	herb Robert	6050600193	Road 6830	passive
TAA 49	Tonga Ridge	yellow hawkweed	6050600203	Road 6846	passive
TAA 49	Tonga Ridge	herb Robert	6050600204	Road 68	passive
TAA 50	North Bend compound	orange hawkweed	05-KW-018	NBRD compound	None
TAA 50	North Bend compound	Bohemian knotweed	05-LP-020	North Bend Compound	None
TAA 51	Diobsud Creek	Himalayan blackberry	6050100017	Mouth of Diobsud Creek	plant rooted stock
TAA 51	Diobsud Creek	Scotch broom	6050100018	Peterson acquisition & rd access	Seed and Mulch
TAA 51	Diobsud Creek	Himalayan blackberry	6050100024	Marblemount boat launch	plant rooted stock
TAA 51	Diobsud Creek	Bohemian knotweed	01-AR-021	Hideaway Lane (Peterson)	passive
TAA 51	Diobsud Creek	Canada thistle	01-AR-051	Marblemount Boat Launch, whole area	planted
TAA 51	Diobsud Creek	Scotch broom	01-AR-068	Taylor spawning channel	passive
TAA 51	Diobsud Creek	Canada thistle	01-AR-069	Taylor spawning channel	passive
TAA 51	Diobsud Creek	common tansy	01-AR-083	Marblemount boat launch, entire area	Seed and Mulch
TAA 51	Diobsud Creek	Bohemian knotweed	01-LP-022	Marblemount boat launch, west end	planted
TAA 52	Marblemount Boat Launch	Bohemian knotweed	01-AR-050	Marblemount Boat Launch, east end	planted

TAA #	TAA Name	Invasive Plant Species	Invasive Plant NRIS #	Invasive Plant Site Name	Revegetation Strategy
TAA 52	Marblemount Boat Launch	Canada thistle	01-AR-051	Marblemount Boat Launch, whole area	planted
TAA 52	Marblemount Boat Launch	hedge false bindweed	01-AR-052	Marblemount Boat Launch, east end	planted
TAA 52	Marblemount Boat Launch	common tansy	01-AR-083	Marblemount boat launch, entire area	Seed and Mulch
TAA 52	Marblemount Boat Launch	Scotch broom	01-AR-084	Marblemount boat launch, near east pkg area	planted
TAA 53	Sulphur Creek	herb Robert	6050200227	Suiattle Trail & trailhead	None
TAA 54	Johnson Ridge	oxeye daisy	6050600045	Scorpion Mountain meadow	None

Appendix C – Susceptibility of Rare Plants to Herbicides

Introduction

Table C- 1 displays the botanical species of conservation concern and their susceptibility to the various herbicides proposed for use in this project. Botanical species of conservation concern include (1) Botanical species that are listed under the federal Endangered Species Act (ESA) as threatened or endangered (or those species candidate/proposed for federal listing); (2) Species on the Regional Forester's Sensitive Species List (R6-Sensitive because they are considered rare throughout the Pacific Northwest Region; (3) Species on the Washington state Se. WA-Sensitive = species that are considered rare in Washington but not Oregon.

Table C- 1. Susceptibility to Herbicide for Botanical Species of Conservation Concern on the MBS

TES or S&M Plant Species Scientific Name; Plant Family; Management Status	Aminopyralid Targets Asteraceae, Fabaceae, Polygonaceae, Solanaceae plant families	Chlorsulfuron Protect individual plants from direct spray, drift, runoff, wind erosion	Clopyralid Targets Asteraceae, Fabaceae, Polygonacea, Solanaceae plant families	Glyphosate Non-selective; protect from direct spray; runoff not a concern.	Imazapic Protect from direct spray, drift, runoff & timing after use of other herbicides	Imazapyr Non-selective; protect plants from direct spray, drift, runoff	Metsulfuron methyl Protect individual plants from direct spray, drift, runoff, wind erosion.	Picloram Targets Asteraceae, Fabaceae, Polygonaceae, Solanaceae plant families. Protect from direct spray drift, runoff. Scrophulariaceae, Brassicacea, Liliaceae less susceptible. Grasses not affected.	Sulfometuron methyl Non-selective; Protect plants from direct spray, drift, runoff, wind erosion	Triclopyr Regional FEIS limits use of triclopyr to selective application techniques
Bartramiopsis lescurii Polystrichaceae WA-Sensitive	No concern – Polystrichacea family not target	Unknown impact; assume worst case and mitigate accordingly	No concern – Polystrichacea family not target	Concern	Unknown impact; assume worst case and mitigate accordingly	Unknown impact; assume worst case and mitigate accordingly	Unknown impact; assume worst case and mitigate accordingly	No concern – Polystrichacea family not target	Unknown impact; assume worst case and mitigate accordingly	Unknown impact; assume worst case and mitigate accordingly
Botrychium ascendens Ophioglossace WA Sensitive	No concern; Ophioglossaceae family not target	Concern	No concern; Ophioglossaceae family not target	Concern	Concern	Concern	Concern	No concern; Ophioglossaceae family not target	Concern	Concern
Botrychium montanum Ophioglossace S&M category D	No concern; Ophioglossaceae family not target	Concern	No concern; Ophioglossaceae family not target	Concern	Concern	Concern	Concern	No concern; Ophioglossaceae family not target	Concern	Concern

TES or S&M Plant Species Scientific Name; Plant Family; Management Status	Aminopyralid Targets Asteraceae, Fabaceae, Polygonaceae, Solanaceae plant families	Chlorsulfuron Protect individual plants from direct spray, drift, runoff, wind erosion	Clopyralid Targets Asteraceae, Fabaceae, Polygonacea, Solanaceae plant families	Glyphosate Non-selective; protect from direct spray; runoff not a concern.	Imazapic Protect from direct spray, drift, runoff & timing after use of other herbicides	Imazapyr Non-selective; protect plants from direct spray, drift, runoff	Metsulfuron methyl Protect individual plants from direct spray, drift, runoff, wind erosion.	Picloram Targets Asteraceae, Fabaceae, Polygonaceae, Solanaceae plant families. Protect from direct spray drift, runoff. Scrophulariaceae, Brassicacea, Liliaceae less susceptible. Grasses not affected.	Sulfometuron methyl Non-selective; Protect plants from direct spray, drift, runoff, wind erosion	Triclopyr Regional FEIS limits use of triclopyr to selective application techniques
Botrychium peduncluosum Ophioglossace R6 Sensitive	No concern; Ophioglossaceae family not target	Concern	No concern; Ophioglossaceae family not target	Concern	Concern	Concern	Concern	No concern; Ophioglossaceae family not target	Concern	Concern
Bridgeoporus nobilissimus Polypore Polyporaceae S&M category A	No concern; Polyporaceae family not target	Unknown impact; assume worst case and mitigate accordingly.	No concern; Polyporaceae family not target	Concern	Unknown impact; assume worst case and mitigate accordingly	Unknown impact; assume worst case and mitigate accordingly	Unknown impact; assume worst case and mitigate accordingly	No concern; Polyporaceae family not target	Unknown impact; assume worst case and mitigate accordingly	Unknown impact; assume worst case and mitigate accordingly
Bryoria tortuosa Parmeliaceae S&M Category A	No concern; Parmeliaceae family not target	Unknown impact; assume worst case and mitigate accordingly.	No concern; Polyporaceae family not target	Concern	Unknown impact; assume worst case and mitigate accordingly	Unknown impact; assume worst case and mitigate accordingly	Unknown impact; assume worst case and mitigate accordingly	No concern; Polyporaceae family not target	Unknown impact; assume worst case and mitigate accordingly	Unknown impact; assume worst case and mitigate accordingly
Campanula lasiocarpa Campanulaceae WA-Sensitive	No concern; Campanulaceae not a target.	Concern	No concern; Campanulaceae not a target.	Concern	Concern	Concern	Concern	No concern; Campanulaceae not a target.	Concern	Concern
Carex comosa Cyperaceae R6-Sensitive	No impact expected. Grasses are not impacted, so it is assumed Carex species are not impacted. Trials should be conducted first before this herbicide is used near these rare species.	No concern. This species of *Carex* occurs along water's edge where this herbicide would not be used.	No concern. This species of *Carex* occurs along water's edge where this herbicide would not be used.	Concern.	No concern. This species of *Carex* occurs along water's edge where this herbicide would not be used.	Concern	No concern. This species of *Carex* occurs along water's edge where this herbicide would not be used.	No concern. This species of *Carex* occurs along water's edge where this herbicide would not be used.	No concern. This species of *Carex* occurs along water's edge where this herbicide would not be used.	Concern

TES or S&M Plant Species **Scientific Name; Plant Family; Management Status**	**Aminopyralid** **Targets Asteraceae, Fabaceae, Polygonaceae, Solanaceae plant families**	**Chlorsulfuron** **Protect individual plants from direct spray, drift, runoff, wind erosion**	**Clopyralid** **Targets Asteraceae, Fabaceae, Polygonacea, Solanaceae plant families**	**Glyphosate** **Non-selective; protect from direct spray; runoff not a concern.**	**Imazapic** **Protect from direct spray, drift, runoff & timing after use of other herbicides**	**Imazapyr** **Non-selective; protect plants from direct spray, drift, runoff**	**Metsulfuron methyl** **Protect individual plants from direct spray, drift, runoff, wind erosion.**	**Picloram** **Targets Asteraceae, Fabaceae, Polygonaceae, Solanaceae plant families. Protect from direct spray drift, runoff.** **Scrophulariaceae, Brassicacea, Liliaceae less susceptible.** **Grasses not affected.**	**Sulfometuron methyl** **Non-selective; Protect plants from direct spray, drift, runoff, wind erosion**	**Triclopyr** **Regional FEIS limits use of triclopyr to selective application techniques**
Carex flava Cyperaceae Removed from R6 list but remains a species of concern on the MBSNF	No impact expected. Grasses are not impacted, so it is assumed Carex species are not impacted. Trials should be conducted first before this herbicide is used near these rare species.	No concern. This species of *Carex* occurs along water's edge where this herbicide would not be used.	No concern. This species of *Carex* occurs along water's edge where this herbicide would not be used.	Concern.	No concern.This species of *Carex* occurs along water's edge where this herbicide would not be used.	Concern.	No concern. This species of *Carex* occurs along water's edge where this herbicide would not be used.	No concern. This species of *Carex* occurs along water's edge where this herbicide would not be used.	No concern. This species of *Carex* occurs along water's edge where this herbicide would not be used.	Concern.
Carex macrochaeta Cyperaceae R6-Sensitive	No impact expected. Grasses are not impacted, so it is assumed Carex species are not impacted. Trials should be conducted first before this herbicide is used near these rare species.	No concern. This species of *Carex* occurs along water's edge where this herbicide would not be used.	No concern. This species of *Carex* occurs along water's edge where this herbicide would not be used.	Concern.	No concern. This species of *Carex* occurs along water's edge where this herbicide would not be used.	Concern.	No concern. This species of *Carex* occurs along water's edge where this herbicide would not be used.	No concern. This species of *Carex* occurs along water's edge where this herbicide would not be used.	No concern. This species of *Carex* occurs along water's edge where this herbicide would not be used.	Concern.

TES or S&M Plant Species Scientific Name; Plant Family; Management Status	**Aminopyralid Targets Asteraceae, Fabaceae, Polygonaceae, Solanaceae plant families**	**Chlorsulfuron Protect individual plants from direct spray, drift, runoff, wind erosion**	**Clopyralid Targets Asteraceae, Fabaceae, Polygonacea, Solanaceae plant families**	**Glyphosate Non-selective; protect from direct spray; runoff not a concern.**	**Imazapic Protect from direct spray, drift, runoff & timing after use of other herbicides**	**Imazapyr Non-selective; protect plants from direct spray, drift, runoff**	**Metsulfuron methyl Protect individual plants from direct spray, drift, runoff, wind erosion.**	**Picloram Targets Asteraceae, Fabaceae, Polygonaceae, Solanaceae plant families. Protect from direct spray drift, runoff. Scrophulariaceae, Brassicacea, Liliaceae less susceptible. Grasses not affected.**	**Sulfometuron methyl Non-selective; Protect plants from direct spray, drift, runoff, wind erosion**	**Triclopyr Regional FEIS limits use of triclopyr to selective application techniques**
Carex magellanica ssp. *irrigua.* Cyperaceae. WA-Sensitive	No impact expected. Grasses are not impacted, so it is assumed Carex species are not impacted. Trials should be conducted first before this herbicide is used near these rare species.	No concern. This species of *Carex* occurs along water's edge where this herbicide would not be used.	No concern. This species of *Carex* occurs along water's edge where this herbicide would not be used.	Concern.	No concern. This species of *Carex* occurs along water's edge where this herbicide would not be used.	Concern.	No concern. This species of Carex occurs along water's edge where this herbicide would not be used.	No concern. This species of *Carex* occurs along water's edge where this herbicide would not be used.	No concern. This species of *Carex* occurs along water's edge where this herbicide would not be used.	Concern.
Carex pauciflora Cyperaceae. WA-Sensitive	No impact expected. Grasses are not impacted, so it is assumed Carex species are not impacted. Trials should be conducted first before this herbicide is used near these rare species.	No concern.This species of *Carex* occurs along water's edge where this herbicide would not be used.	No concern.This species of *Carex* occurs along water's edge where this herbicide would not be used.	Concern.	No concern. This species of *Carex* occurs along water's edge where this herbicide would not be used.	Concern.	No concern.This species of *Carex* occurs along water's edge where this herbicide would not be used.	No concern. This species of *Carex* occurs along water's edge where this herbicide would not be used.	No concern. This species of *Carex* occurs along water's edge where this herbicide would not be used.	Concern.

TES or S&M Plant Species **Scientific Name; Plant Family; Management Status**	**Aminopyralid** **Targets Asteraceae, Fabaceae, Polygonaceae, Solanaceae plant families**	**Chlorsulfuron** **Protect individual plants from direct spray, drift, runoff, wind erosion**	**Clopyralid** **Targets Asteraceae, Fabaceae, Polygonacea, Solanaceae plant families**	**Glyphosate** **Non-selective; protect from direct spray; runoff not a concern.**	**Imazapic** **Protect from direct spray, drift, runoff & timing after use of other herbicides**	**Imazapyr** **Non-selective; protect plants from direct spray, drift, runoff**	**Metsulfuron methyl** **Protect individual plants from direct spray, drift, runoff, wind erosion.**	**Picloram** **Targets Asteraceae, Fabaceae, Polygonaceae, Solanaceae plant families. Protect from direct spray drift, runoff.** **Scrophulariaceae, Brassicacea, Liliaceae less susceptible. Grasses not affected.**	**Sulfometuron methyl** **Non-selective; Protect plants from direct spray, drift, runoff, wind erosion**	**Triclopyr** **Regional FEIS limits use of triclopyr to selective application techniques**
Carex rostrata Cyperaceae. WA-Sensitive	No impact expected. Grasses are not impacted, so it is assumed Carex species are not impacted. Trials should be conducted first before this herbicide is used near these rare species.	No concern. This species of *Carex* occurs along water's edge where this herbicide would not be used.	No concern. This species of *Carex* occurs along water's edge where this herbicide would not be used.	Concern.	No concern. This species of *Carex* occurs along water's edge where this herbicide would not be used.	Concern.	No concern. This species of *Carex* occurs along water's edge where this herbicide would not be used.	No concern. This species of *Carex* occurs along water's edge where this herbicide would not be used.	No concern. This species of *Carex* occurs along water's edge where this herbicide would not be used.	Concern.
Carex scirpoidea ssp. scirpoidea Cyperaceae. WA-Sensitive	No impact expected. Grasses are not impacted, so it is assumed Carex species are not impacted. Trials should be conducted first before this herbicide is used near these rare species.	N/A. This species of *Carex* occurs along water's edge where this herbicide would not be used.	N/A. This species of *Carex* occurs along water's edge where this herbicide would not be used.	Concern.	N/A. This species of *Carex* occurs along water's edge where this herbicide would not be used.	Concern.	N/A. This species of *Carex* occurs along water's edge where this herbicide would not be used.	N/A. This species of *Carex* occurs along water's edge where this herbicide would not be used.	N/A. This species of *Carex* occurs along water's edge where this herbicide would not be used.	Concern.

TES or S&M Plant Species Scientific Name; Plant Family; Management Status	Aminopyralid Targets Asteraceae, Fabaceae, Polygonaceae, Solanaceae plant families	Chlorsulfuron Protect individual plants from direct spray, drift, runoff, wind erosion	Clopyralid Targets Asteraceae, Fabaceae, Polygonacea, Solanaceae plant families	Glyphosate Non-selective; protect from direct spray; runoff not a concern.	Imazapic Protect from direct spray, drift, runoff & timing after use of other herbicides	Imazapyr Non-selective; protect plants from direct spray, drift, runoff	Metsulfuron methyl Protect individual plants from direct spray, drift, runoff, wind erosion.	Picloram Targets Asteraceae, Fabaceae, Polygonaceae, Solanaceae plant families. Protect from direct spray drift, runoff. Scrophulariaceae, Brassicacea, Liliaceae less susceptible. Grasses not affected.	Sulfometuron methyl Non-selective; Protect plants from direct spray, drift, runoff, wind erosion	Triclopyr Regional FEIS limits use of triclopyr to selective application techniques
Carex stylosa Cyperaceae. WA-Sensitive	No impact expected. Grasses are not impacted, so it is assumed Carex species are not impacted. Trials should be conducted first before this herbicide is used near these rare species.	N/A. .This species of *Carex* occurs along water's edge where this herbicide would not be used.	N/A. This species of *Carex* occurs along water's edge where this herbicide would not be used.	Concern.	N/A. This species of Carex occurs along water's edge where this herbicide would not be used.	Concern.	N/A. This species of Carex occurs along water's edge where this herbicide would not be used.	N/A. This species of Carex occurs along water's edge where this herbicide would not be used.	N/A. This species of Carex occurs along water's edge where this herbicide would not be used.	Concern.
Castilleja cryptantha Scrophulariaceae. WA-Sensitive	No concern; Scrophulariaceae not targeted by this herbicide.	Concern.	No. Scrophulariaceae not target	Concern.	Concern.	Concern.	Concern.	Possible concern but Scrophulariaceae less susceptible than other families to impacts from this herbicide.	Concern	Concern.
Chaenactis thompsonii. Scrophulariaceae. WA-Sensitive	No concern; Scrophulariaceae not targeted by this herbicide.	Concern	No concern; Scrophulariaceae not targeted by this herbicide.	Concern	Concern	Concern	Concern	Possible concern but Scrophulariaceae less susceptible than other families to impacts from this herbicide.	Concern	Concern
Cladonia norvegica. Cladoniaceae. S&M Category C	No concern; Cladoniaceae family not targeted by this herbicide.	Unknown impact; assume worst case and mitigate accordingly.	No concern; Cladoniaceae not target	Concern	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.	No concern; Cladoniaceae not target	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.

TES or S&M Plant Species Scientific Name; Plant Family; Management Status	Aminopyralid Targets Asteraceae, Fabaceae, Polygonaceae, Solanaceae plant families	Chlorsulfuron Protect individual plants from direct spray, drift, runoff, wind erosion	Clopyralid Targets Asteraceae, Fabaceae, Polygonacea, Solanaceae plant families	Glyphosate Non-selective; protect from direct spray; runoff not a concern.	Imazapic Protect from direct spray, drift, runoff & timing after use of other herbicides	Imazapyr Non-selective; protect plants from direct spray, drift, runoff	Metsulfuron methyl Protect individual plants from direct spray, drift, runoff, wind erosion.	Picloram Targets Asteraceae, Fabaceae, Polygonaceae, Solanaceae plant families. Protect from direct spray drift, runoff. Scrophulariaceae, Brassicacea, Liliaceae less susceptible. Grasses not affected.	Sulfometuron methyl Non-selective; Protect plants from direct spray, drift, runoff, wind erosion	Triclopyr Regional FEIS limits use of triclopyr to selective application techniques
Coptis aspleniifolia Ranunculaceae. WA-Sensitive and S&M Category A	No concern. Ranunculaceae family not targeted by this herbicide.	Concern	No Ranunculaceae not target	Concern	Concern	Concern	Concern	No Ranunculacea not target	Concern	Concern
Coptis trifolia Ranunculaceae. S&M Category A	No concern. Ranunculaceae family not targeted by this herbicide.	Concern	No Ranunculaceae not target	Concern	Concern	Concern	Concern	No Ranunculacea not target	Concern	Concern
Cypripedium fasiculatum Orchidaceae. S&M Category C	No concern. Orchidaceae family not targeted by this herbicide.	Concern	No Orchidaceae not target	Concern	Concern	Concern	Concern	No Orchidaceae not target	Concern	Concern
Cypripedium montanum Orchidaceae. S&M Category C	No concern. Orchidaceae family not targeted by this herbicide	Concern	No Orchidaceae not target	Concern	Concern	Concern	Concern	No Orchidaceae not target	Concern	Concern
Corydalis aquae-gelidae Fumariaceae. S&M Category C	No concern. Fumariaceae family not targeted by this herbicide	Concern	No Fumariaceae not target	Concern	Concern	Concern	Concern	No Fumariaceae not target	Concern	Concern
Dendriscocaulon intricatulatum Lobariaceae. S&M Category A	No concern – Lobariaceae family not targeted by this herbicide.	Not sure; assume worst case	No concern – this family not target	Concern	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.	No concern – this family not target	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.

TES or S&M Plant Species Scientific Name; Plant Family; Management Status	Aminopyralid Targets Asteraceae, Fabaceae, Polygonaceae, Solanaceae plant families	Chlorsulfuron Protect individual plants from direct spray, drift, runoff, wind erosion	Clopyralid Targets Asteraceae, Fabaceae, Polygonacea, Solanaceae plant families	Glyphosate Non-selective; protect from direct spray; runoff not a concern.	Imazapic Protect from direct spray, drift, runoff & timing after use of other herbicides	Imazapyr Non-selective; protect plants from direct spray, drift, runoff	Metsulfuron methyl Protect individual plants from direct spray, drift, runoff, wind erosion.	Picloram Targets Asteraceae, Fabaceae, Polygonaceae, Solanaceae plant families. Protect from direct spray drift, runoff. Scrophulariaceae, Brassicacea, Liliaceae less susceptible. Grasses not affected.	Sulfometuron methyl Non-selective; Protect plants from direct spray, drift, runoff, wind erosion	Triclopyr Regional FEIS limits use of triclopyr to selective application techniques
Dryas drummondii var. *drummondii* Rosaceae. WA-Sensitive	No concern - Rosaceae family not targeted by this herbicide.	Concern	No Rosaceae not target	Concern	Concern	Concern	Concern	No Rosaceae not target	Concern	Concern
Erigeron salishii Asteraceae. WA-Sensitive	Concern - Asteraceae is targeted by this herbicide.	Concern	Concern - Asteraceae is target	Concern	Concern	Concern	Concern	Concern - Asteraceae is a target	Concern	Concern
Eucephalis vialis Asteraceae. S&M Category A	Concern - Asteraceae is targeted by this herbicide.	Concern	Concern - Asteraceae is target	Concern	Concern	Concern	Concern	Concern - Asteraceae is a target	Concern	Concern
Eurybia merita Asteraceae. WA-Sensitive	Concern - Asteraceae is targeted by this herbicide.	Concern	Concern - Asteraceae is target	Concern	Concern	Concern	Concern	Concern - Asteraceae is a target	Concern	Concern
Fritillaria camschatcensis Liliaceae. R6-Sensitive	No concern. Liliaceae not targeted by this herbicide.	Concern	No concern. Liliaceae not targeted by this herbicide.	Concern	Concern	Concern	Concern	Lesser concern. This herbicide targets Asteraceae, Fabaceae, Polygonaceae, Solanaceae plant families. Liliaceae less susceptible.	Concern	Concern
Galium kamtschaticum Rubiaceae. S&M category A, south of Snoqualmie Pass only.	No concern. Rubiaceae family not targeted by this herbicide.	N/A because this species occurs in saturated soils where this herbicide would not be used.	N/A because this species occurs in saturated soils where this herbicide would not be used.	Concern	N/A because this species occurs in saturated soils where this herbicide would not be used.	Concern. Aquatic Imazapyr could be used; Apply MR and MMs	N/A because this species occurs in saturated soils where this herbicide would not be used.	No Rubiaceae not target.	N/A because this species occurs in saturated soils where this herbicide would not be used.	Concern

TES or S&M Plant Species **Scientific Name; Plant Family; Management Status**	**Aminopyralid** **Targets Asteraceae, Fabaceae, Polygonaceae, Solanaceae plant families**	**Chlorsulfuron** **Protect individual plants from direct spray, drift, runoff, wind erosion**	**Clopyralid** **Targets Asteraceae, Fabaceae, Polygonacea, Solanaceae plant families**	**Glyphosate** **Non-selective; protect from direct spray; runoff not a concern.**	**Imazapic** **Protect from direct spray, drift, runoff & timing after use of other herbicides**	**Imazapyr** **Non-selective; protect plants from direct spray, drift, runoff**	**Metsulfuron methyl** **Protect individual plants from direct spray, drift, runoff, wind erosion.**	**Picloram** **Targets Asteraceae, Fabaceae, Polygonaceae, Solanaceae plant families. Protect from direct spray drift, runoff.** **Scrophulariaceae, Brassicacea, Liliaceae less susceptible. Grasses not affected.**	**Sulfometuron methyl** **Non-selective; Protect plants from direct spray, drift, runoff, wind erosion**	**Triclopyr** **Regional FEIS limits use of triclopyr to selective application techniques**
Gaultheria hispidula Ericaceae. WA-Sensitive	No concern. Ericaceae family not targeted by this herbicide.	Concern	No Ericaceae not target	Concern	Concern	Concern	Concern	No Ericaceae not target	Concern	Concern
Gentiana douglasiana Gentianaceae. WA-Sensitive	No concern - Gentianaceae not target.	N/A because this species usually occurs along water's edge where this herbicide would not be used.	N/A because this species usually occurs along water's edge where this herbicide would not be used.	Concern.	N/A because this species usually occurs along water's edge where this herbicide would not be used.	Concern. Aquatic Imazapyr could be used; Apply MR and MMs	N/A because this species usually occurs along water's edge where this herbicide would not be used.	No. Targets Asteraceae, Fabaceae, Polygonacea, Solanaceae plant families.	N/A because this species usually occurs along water's edge where this herbicide would not be used.	Concern. If Aquatic Triclopyr used, apply MR and MMs
Gentiana glauca Gentianaceae WA-Sensitive	No concern; Gentianaceae not targeted by this herbicide.	Concern	No Gentianaceae not target	Concern	Concern	Concern	Concern	No Gentianaceae not target	Concern	Concern
Hypogymnia duplicata Parmeliaceae. S&M Category C	No – Parmeliaceae family not targeted by this herbicide.	Unknown impact; assume worst case and mitigate accordingly.	No – Parmeliaceae not target	Concern	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.	No – Parmeliaceae not target	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.
Leptogium burnetiae var. *hirsutum* Collemataceae. S&M Category A	No concern; Collemataceae family not targeted by this herbicide.	Unknown impact; assume worst case and mitigate accordingly.	No – concern. Collemataceae family not targeted by this herbicide.	Concern	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.	No – this family not target	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.

TES or S&M Plant Species Scientific Name; Plant Family; Management Status	Aminopyralid Targets Asteraceae, Fabaceae, Polygonaceae, Solanaceae plant families	Chlorsulfuron Protect individual plants from direct spray, drift, runoff, wind erosion	Clopyralid Targets Asteraceae, Fabaceae, Polygonacea, Solanaceae plant families	Glyphosate Non-selective; protect from direct spray; runoff not a concern.	Imazapic Protect from direct spray, drift, runoff & timing after use of other herbicides	Imazapyr Non-selective; protect plants from direct spray, drift, runoff	Metsulfuron methyl Protect individual plants from direct spray, drift, runoff, wind erosion.	Picloram Targets Asteraceae, Fabaceae, Polygonaceae, Solanaceae plant families. Protect from direct spray drift, runoff. Scrophulariaceae, Brassicacea, Liliaceae less susceptible. Grasses not affected.	Sulfometuron methyl Non-selective; Protect plants from direct spray, drift, runoff, wind erosion	Triclopyr Regional FEIS limits use of triclopyr to selective application techniques
Leptogium cyanescens Collemataceae. S&M Category A	No concern; Collemataceae family not targeted by this herbicide.	Unknown impact; assume worst case and mitigate accordingly.	No – concern. Collemataceae family not targeted by this herbicide.	Concern	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.	No – this family not target	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.
Lobaria linita var. *tenuoir* Lobariaceae S&M Category A (south of Snoqualmie Pass only)	No concern; Lobariaceae family not targeted by this herbicide.	Unknown impact; assume worst case and mitigate accordingly.	No concern. Lobariaceae family not targeted by this herbicide.	Concern	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.	No – this family not target	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.
Loiseleuria procumbens Ericaceae WA-Sensitive	No concern. Ericaceae family not target	Concern	No Ericaceae not target	Concern	Concern	Concern	Concern	No Ericaceae not target	Concern	Concern
Luzula arcuata ssp. *unalaskensis* Juncaceae. R6-Sensitive	No concern; Juncaceae not target	Concern	No Juncaceae not target	Concern	Concern	Concern	Concern	No. Targets Asteraceae, Fabaceae, Polygonacea, Solanaceae plant families.Grasses not affected, so assume Juncaceae also not affected.	Concern	Concern

TES or S&M Plant Species Scientific Name; Plant Family; Management Status	Aminopyralid Targets Asteraceae, Fabaceae, Polygonaceae, Solanaceae plant families	Chlorsulfuron Protect individual plants from direct spray, drift, runoff, wind erosion	Clopyralid Targets Asteraceae, Fabaceae, Polygonacea, Solanaceae plant families	Glyphosate Non-selective; protect from direct spray; runoff not a concern.	Imazapic Protect from direct spray, drift, runoff & timing after use of other herbicides	Imazapyr Non-selective; protect plants from direct spray, drift, runoff	Metsulfuron methyl Protect individual plants from direct spray, drift, runoff, wind erosion.	Picloram Targets Asteraceae, Fabaceae, Polygonaceae, Solanaceae plant families. Protect from direct spray drift, runoff. Scrophulariaceae, Brassicacea, Liliaceae less susceptible. Grasses not affected.	Sulfometuron methyl Non-selective; Protect plants from direct spray, drift, runoff, wind erosion	Triclopyr Regional FEIS limits use of triclopyr to selective application techniques
Lycopodiella inundata Lycopodiaceae. R6-Sensitive	No concern; Lycopodiaceae not targeted by this herbicide.	Concern	No Lycopodiaceae not target and *Lycopodiella inundata* occurs along water's edge where this herbicide would not be used.	Concern	No. *Lycopodiella inundata* occurs along water's edge where this herbicide would not be used.	Concern.	No. *Lycopodiella inundata* occurs along water's edge where this herbicide would not be used.	No Lycopodiaceae not target	No. *Lycopodiella inundata* occurs along water's edge where this herbicide would not be used.	Concern. If Aquatic Triclopyr used, apply MR and MMs
Lycopodium dendroidium Lycopodiaceae. WA-Sensitive	No concern; Lycopodiaceae not targeted by this herbicide.	Concern	No Lycopodiaceae not target	Concern	Concern	Concern	Concern	No Lycopodiaceae not target	Concern	Concern
Microseris borealis Asteraceae. WA-Sensitive	No Concern - Asteraceae is not targeted by this herbicide.	Concern	Concern - Asteraceae is target	Concern	Concern	Concern	Concern	Concern - Asteraceae is a target	Concern	Concern
Montia diffusa Portulacaceae. WA-Sensitive	No concern; Portulacaceae family not a targeted by this herbicide.	Concern	No. Portulacaceae not a target.	Concern	Concern	Concern	Concern	No. Portulacaceae not a target.	Concern	Concern
Niebla cepahlota Ramalinaceae. S&M Category A	No concern; Ramalinaceae family not a targeted by this herbicide.	Not sure; assume worst case	No – Ramalinaceae not target	Concern	Not sure; assume worst case	Not sure; assume worst case	Not sure; assume worst case	No – Ramalinaceae not target	Not sure; assume worst case	Not sure; assume worst case
Nephroma occultum Nephromataceae. S&M Category A	No concern; Nephromataceae family not a targeted by this herbicide.	Not sure; assume worst case	No – Nephromataceae not target	Concern	Not sure; assume worst case	Not sure; assume worst case	Not sure; assume worst case	No – Nephromataceae not target	Not sure; assume worst case	Not sure; assume worst case

TES or S&M Plant Species Scientific Name; Plant Family; Management Status	Aminopyralid Targets Asteraceae, Fabaceae, Polygonaceae, Solanaceae plant families	Chlorsulfuron Protect individual plants from direct spray, drift, runoff, wind erosion	Clopyralid Targets Asteraceae, Fabaceae, Polygonacea, Solanaceae plant families	Glyphosate Non-selective; protect from direct spray; runoff not a concern.	Imazapic Protect from direct spray, drift, runoff & timing after use of other herbicides	Imazapyr Non-selective; protect plants from direct spray, drift, runoff	Metsulfuron methyl Protect individual plants from direct spray, drift, runoff, wind erosion.	Picloram Targets Asteraceae, Fabaceae, Polygonaceae, Solanaceae plant families. Protect from direct spray drift, runoff. Scrophulariaceae, Brassicacea, Liliaceae less susceptible. Grasses not affected.	Sulfometuron methyl Non-selective; Protect plants from direct spray, drift, runoff, wind erosion	Triclopyr Regional FEIS limits use of triclopyr to selective application techniques
Packera porteri Asteraceae WA-Sensitive	No concern; Asteraceae family not a targeted by this herbicide.	Concern	Concern - Asteraceae is target	Concern	Concern	Concern	Concern	Concern - Asteraceae is a target	Concern	Concern
Pedicularis rainierensis Scrophulariaceae. WA-Sensitive	No. Scrophulariaceae not target	Concern.	No. Scrophulariaceae not target	Concern.	Concern.	Concern.	Concern.	No. Scrophulariaceae less susceptible	Concern	Concern.
Pellaea breweri Polypodiaceae WA-Sensitive	No. Polypodiaceae not target	Concern.	No. Polypodiaceae not target	Concern.	Concern.	Concern.	Concern.	No. Polypodiaceae less susceptible	Concern	Concern.
Pinus albicaulis Pinaceae R6-Sensitive	No. Pinaceae not target	Concern.	No. Pinaceae not target	Concern.	Concern.	Concern.	Concern.	No. Pinaceae less susceptible	Concern	Concern.
Platanthera chorisiana Orchidaceae. WA-Sensitive	No Orchidaceae not target	No. This species usually occurs along water's edge where this herbicide would not be used.	No. Orchidaceae not target and this species usually occurs along water's edge where this herbicide would not be used.	Concern.	No. This species usually occurs along water's edge where this herbicide would not be used.	Concern. Aquatic Imazapyr could be used; Apply MR and MMs	No. This species usually occurs along water's edge where this herbicide would not be used.	No. Targets Asteraceae, Fabaceae, Polygonacea, Solanaceae plant families.	No. This species usually occurs by water's edge where this herbicide would not be used.	Concern. If Aquatic Triclopyr used, apply MR and MMs
Platanthera obtusata Orchidaceae. R6-Sensitive	No Orchidaceae not target	Concern	No Orchidaceae not target	Concern	Concern	Concern	Concern	No Orchidaceae not target	Concern	Concern
Platanthera orbiculata var. *orbiculata* Orchidaceae. S&M Category C	No Orchidaceae not target	Concern	No Orchidaceae not target	Concern	Concern	Concern	Concern	No Orchidaceae not target	Concern	Concern

TES or S&M Plant Species Scientific Name; Plant Family; Management Status	Aminopyralid Targets Asteraceae, Fabaceae, Polygonaceae, Solanaceae plant families	Chlorsulfuron Protect individual plants from direct spray, drift, runoff, wind erosion	Clopyralid Targets Asteraceae, Fabaceae, Polygonacea, Solanaceae plant families	Glyphosate Non-selective; protect from direct spray; runoff not a concern.	Imazapic Protect from direct spray, drift, runoff & timing after use of other herbicides	Imazapyr Non-selective; protect plants from direct spray, drift, runoff	Metsulfuron methyl Protect individual plants from direct spray, drift, runoff, wind erosion.	Picloram Targets Asteraceae, Fabaceae, Polygonaceae, Solanaceae plant families. Protect from direct spray drift, runoff. Scrophulariaceae, Brassicacea, Liliaceae less susceptible. Grasses not affected.	Sulfometuron methyl Non-selective; Protect plants from direct spray, drift, runoff, wind erosion	Triclopyr Regional FEIS limits use of triclopyr to selective application techniques
Platanthera sparsiflora Orchidaceae. R6-Sensitive	No Orchidaceae not target	Concern	No Orchidaceae not target	Concern	Concern	Concern	Concern	No Orchidaceae not target	Concern	Concern
Platismatia lacunosa Parmeliaceae. S&M Category C	No – Parmeliaceae family not targeted by this herbicide.	Unknown impact; assume worst case and mitigate accordingly.	No – Parmeliaceae not target	Concern	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.	No – Parmeliaceae not target	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.
Pseudocyphellaria rainierensis Lobariaceae. S&M Category A	No concern; Lobariaceae family not targeted by this herbicide.	Unknown impact; assume worst case and mitigate accordingly.	No concern. Lobariaceae family not targeted by this herbicide.	Concern	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.	No – this family not target	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.
Ramalina thrausta Ramalinaceae. S&M Category A	No concern; Ramalinaceae family not targeted by this herbicide.	Unknown impact; assume worst case and mitigate accordingly.	No concern. Ramalinaceae family not targeted by this herbicide.	Concern	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.	No – this family not target	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.
Ranunculus coolayae Ranunculaceae. WA-Sensitive	No Ranunculaceae family not targeted by this herbicide.	Concern	No Ranunculaceae not target	Concern	Concern	Concern	Concern	No Ranunculacea not target	Concern	Concern
Schistostega pennata Schistostegaceae. S&M Category A	No concern; Schistostegaceae family not targeted by this herbicide.	Unknown impact; assume worst case and mitigate accordingly.	No concern. Schistostegaceae family not targeted by this herbicide.	Concern	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.	No – this family not target	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.

TES or S&M Plant Species **Scientific Name; Plant Family; Management Status**	**Aminopyralid** **Targets Asteraceae, Fabaceae, Polygonaceae, Solanaceae plant families**	**Chlorsulfuron** **Protect individual plants from direct spray, drift, runoff, wind erosion**	**Clopyralid** **Targets Asteraceae, Fabaceae, Polygonacea, Solanaceae plant families**	**Glyphosate** **Non-selective; protect from direct spray; runoff not a concern.**	**Imazapic** **Protect from direct spray, drift, runoff & timing after use of other herbicides**	**Imazapyr** **Non-selective; protect plants from direct spray, drift, runoff**	**Metsulfuron methyl** **Protect individual plants from direct spray, drift, runoff, wind erosion.**	**Picloram** **Targets Asteraceae, Fabaceae, Polygonaceae, Solanaceae plant families. Protect from direct spray drift, runoff.** **Scrophulariaceae, Brassicacea, Liliaceae less susceptible. Grasses not affected.**	**Sulfometuron methyl** **Non-selective; Protect plants from direct spray, drift, runoff, wind erosion**	**Triclopyr** **Regional FEIS limits use of triclopyr to selective application techniques**
Teloschistes flavicans Teloschistaceae. S&M Category A	No concern; Tetraphidaceae family not targeted by this herbicide.	Unknown impact; assume worst case and mitigate accordingly.	No concern. Tetraphidaceae family not targeted by this herbicide.	Concern	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.	No – this family not target	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.
Tetraphis geniculata Tetraphidaceae. S&M Category A	No concern; Tetraphidaceae family not targeted by this herbicide.	Unknown impact; assume worst case and mitigate accordingly.	No concern. Tetraphidaceae family not targeted by this herbicide.	Concern	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.	No – this family not target	Unknown impact; assume worst case and mitigate accordingly.	Unknown impact; assume worst case and mitigate accordingly.

Appendix D – Road Segments that Pose Higher Risk of Herbicide Delivery to Fish Habitat

Roads are the primary conduit for invasive plants to enter the Forest. Treatments along roadsides may deliver herbicide to streams via roadside ditches. Ditches may function as an intermittent or perennial stream, extending the stream network. Roadside ditches can act as delivery routes or intermittent streams during high rainfalls or as settling ponds following rainfall events.

Geographical Information System (GIS) was used to identify roads that pose higher risk of herbicide delivery to fish-bearing streams. Roads located within 200 feet of fish-bearing streams are considered to pose the highest threat from herbicide delivery from treatment within the road prism (includes cut and fill slopes). At least one segment of each of the roads in Table D- 1 come within 200 feet of a fish bearing stream. Please note that not all roads are named.

About 1,200 acres of invasive plants lie within 25 feet of roads that pose higher risk of herbicide delivery to fish bearing streams.

Maps of the roads segments identified as higher risk follow. Fish bearing stream crossings are also shown.

Table D- 1. Roads that Pose Higher Risk of Herbicide Delivery to Fish-Bearing Streams

Road ID	Road Name
1040000	OLSON CR
1050000	DIOBSUD CR
1060000	BACON CR
1060020	SETTLER
1064000	W BACON CR
1065000	S BACON
1100000	BAKER LAKE HWY
1100013	SHAKE BOLT
1100017	KOMO POWERHOUSE
1105011	DEPRESSION LAKE
1107000	ANDERSON
1107011	SIDEHILL
1118000	DRY CR
1118012	HORSESHOE COVE CG
1118013	NORTH BAY VIEW CG
1122000	LOWER SANDY CR
1122011	LOWER SANDY BRANCH
1125000	W SANDY CR
1130000	MARTEN LAKE
1137000-A	PANOROAMA PT CG BOAT RAMP

Road ID	Road Name
1140000	TARR PIT
1142000-A	RESORT SPUR-A
1142000-B	RESORT SPUR-B
1144000	MOROVITZ CR
1144012	MOROVITZ CG
1148000	OLD LAKE
1150000-A	SHANNON CR CG-A
1160000	E SHANNON CR
1200000	LOOMIS NOOKSACK
1200011	LOWER ROCKY CR
1260000	SISTERS MTN
1400000	JACKMAN-THUNDER
1500020	WITHDRAWAL
1530000	MARBLE CR CG
1550000	IRENE CR
1570000	FOUND CREEK
1571000	SONNY BOY
1600000	ILLABOT
1610000	WEST BOUNDARY
1700000	FINNEY-CUMBERLAND
1715000	SUTTER MTN
1730000	CLENDENEN CR
1740111	FINNEY GS
1749000	VERRILL

Road ID	Road Name
1750000	DEFOREST CR
1755000	LITTLE DEER PEAK
1800000	SEGELSEN
1820000	WESTSIDE HIGGINS
1820015	TALUS
1840000	HAWKINS LAKE
1850000	CONEY PASS RD 3403
1870000	SEGEL
2000000	MOUNTAIN LOOP HIGHWAY
2010000	FRENCH CR
2010011	FRENCH CR CG
2020000	LITTLE FRENCH CREEK
2030000	MOOSE CR
2040000	SQUIRE CR
2060000	CLEAR CREEK
2079000	2079
2080000	FALLS CR
2130000	N SIDE DANS CR
2200000	NORTH SIDE SAUK RIVER
2200012	BOAT LAUNCH
2200110	2200110
2300000	WHITECHUCK
2300016	OWL CR CG
2430000	DECLINE
2435000	UPPER DECLINE
2500000	S SIDE SUIATTLE
2500016	STRAIGHT CR CG
2500017	WET SWAMP -SEED ORCHARD-
2500019	CAPTIAN MOSES SEED ORCH*
2509000	ALL CREEK PIT SITE
2520000	OLD STRAIGHT
2530000	INDIAN SPUR
2540000	HARRIET CREEK
2540012	LOWER MARSH
2600000	SUIATTLE ROAD
2600014	W BUCK CR CG
2600016	SUIATTLE GUARD STA
2600016-A	SUIATTLE GUARD STA LOOP A
2600025	SULPHUR CR CG
2600025-A	SULPHUR CR CG-A
2600027	SUIATTLE TRAIL HEAD
2640000	GRADE CR
2642000	W GRADE CR
2670000	DOE CR
2700000	STRAIGHT CR
2800000	NORTH FORK STILLY
2810000	NORTH MTN
2820000	N FK STILLAGUAM
3010035	GALLOP CR
3018000	HUMPY
3020000	DOUGLAS FIR CG
3020000-A	DOUGLAS FIR CG-A
3030000	NOOKSACK CG
3030000-A	NOOKSACK CG SPUR-A
3035000	FOURMILE
3045000	EXCELSIOR CG
3066000	SWAMP CR
3070000	RAZOR HONE
3071000	ANDERSON CR
3100000	CANYON CR
3130000	KIDNEY CR
3140000	CANYON RIDGE
3142000	BANYON
3160000	WHISTLER CR
3170000	BEARPAW
3200000	HANNEGAN
3200015	NANNY GOAT
3200024	SEFRIT
3300000	WELLS CR
3400000	NO FK NOOKSACK
3700000	DEADHORSE
3700030	TAIL HOLD
3722000	BRIDGE CAMP
3800000	MID FK NOOKSACK
3800023	RIDLEY CR
3900000	GLACIER CR
3910000	THOMPSON CR
3914000	BEAVER CR
3940000	SMITH-BASIN
4000040	ESWINE CG
4000043	DICK SPERRY CG
4000045	SPERRY IVERSON PARKING

Road ID	Road Name
4000050	MARBLE GULCH PARKING
4000060	COAL CR BAR CG
4000064	BEAVER CR CG
4002000	TURLO CR CG
4004000	VERLOT CG
4004000-A	VERLOT CG SPUR -A
4008000	HEMPLE CR CG
4009000	HEMPLE CR
4012000	LOWER HEMPLE
4030000	MALLARDY CR
4031000	BENDER CR
4032000	BOARDMAN RIDGE
4036000	RED BRIDGE CG
4037000	RIVER ROAD
4041000	SILVER
4052000	DEER CREEK
4059000	BIG FOUR TRAILHEAD
4060000	COAL LAKE
4062000	BEAVER CR
4065000	SUNRISE MINE
4110014	LOWER GREEN MTN
4111000	CANYON LAKE
4150000	N FK CANYON CR
4200000	PILCHUCK
4210000	LOWER PILCHUCK
4220000	JODE
4900000	SLOAN CREEK
4900020	SLOAN CR CG
5000000	CEDAR MAINLINE
5200000	TACOMA PASS
5200210	--
5230000	PIONEER CR.
5400000	STAMPEDE PASS/GREEN RIVER RD
5400610	BORUP
5403000	LIZARD LAKE/BORUP
5403108	--
5415000	LAST CHANCE
5460000	SMAY CREEK
5460510	--
5500000	TINKHAM

Road ID	Road Name
5500210	--
5500410	POWERLINE ACCESS-HANSEN CR
5500411	SOUTHFORK THIN
5501000	TINKHAM CG
5600000	MIDDLE FORK/GOLDMEYER
5600520	TAYLOR RIVER CG
5640000	QUARTZ CREEK
5640101	TAYLOR RIVER
5700000	CO. RD.
5710000	CALLIGAN LAKE
5720000	SUNDAY CREEK
5730000	NORTH FORK ROAD
5800000	DENNY CREEK
5810000	DENNY CREEK CG
5830000	FRANKLIN FALLS TRAILHEAD
6000610	2691 RIVERVIEW CG
6000700	--
6000820	2634 DECEPTION CR
6020000	276 LK SERENE
6020312	HUC
6024000	278 BARCLAY CR
6024210	278-C BARCLAY STUB
6024510	HUC
6030000	2612 LOW CR
6030110	--
6126110	--
6126120	--
6200000	NORTH FORK TOLT RD 261
6220000	2701 PROCTOR CR.
6260000	SOUTH FORK TOLT
6300000	290 N. FK. SKYKOMISH
6300390	--
6300410	TROUBLESOME CR CG-BOTH LOOPS
6300440	2807 SAN JUAN CG
6300510	GARLAND HOT SPRINGS
6300750	--
6300820	2829 DEER FALLS
6305000	LEWIS CREEK/N HAYBROOK TS
6330000	282 SALMON CR.

Road ID	Road Name
6335000	291 MINERAL CITY
6340000	2863 SILVER CRK.
6400110	2606 MONEY CR CG
6410000	2516 MILLER RIV
6410210	2516-B CASHMAN
6412000	2522 E.F. MILLER RIVER
6420000	2601 MONEY CR
6420350	TRAMWAY
6422000	2633 TEMPLE MTN
6422105	--
6435000	260-A MALONEY CR.
6500000	280 BECKLER RIVER
6500104	PAT'S KNOB
6510000	2632 BOLT CRK
6510050	SEC 18
6520000	273 JOHNSON CR
6530000	270 RAPID RIVER
6550000	280 BECKLER RIV
6800000	2622 FOSS RIV
6810000	2622-A E FK FOSS
6830000	2605 TONGA RDG.
6835000	W FORK FOSS
7000000	GREENWATER
7000118	HUC
7000119	HUC
7010000	MIDNIGHT CREEK
7010110	FORTUNE
7013000	FOSS CREEK
7015000	UPPER FOSS CREEK
7020000	SLIDE WEST
7020110	--
7030000	HIMES/TWIN CAMP/WHISTLER CREEK
7030110	LOWER HIMES CAMP
7031000	SKIN ALLEY
7033000	GREENWATER LAKES TRAIL
7138000	HUC

Road ID	Road Name
7140000	OLD TWIN CAMP
7148000	DALLES CG
7150000	DALLES SUMMER HOMES
7160000	BUCK CREEK
7160130	--
7180000	SILVER SPRINGS CG
7180000-A	SILVER SPRINGS CG-A
7180000-C	SILVER SPRINGS CG-C
7190610	CRYSTAL MTN SPUR
7200000	TWENTY-EIGHT MILE CREEK
7200148	WEST TWENTY EIGHT MILE CREEK
7220000	ECHO LAKE
7300000	HUCKLEBERRY CREEK
7300160	LOST CREEK
7300195	LOWER ELEANOR CREEK
7305000	DICKMAN
7320000	WEST HUCKLEBERRY
7400000	WEST FORK/MARTIN GAP
7400050	MALATNITCH PARK/HAZARD CREEK
7410000	WRONG CREEK/W FORK WHITE RIVER
7415000	WEST VALLEY/HAZZARD CREEK
7415210	HAZZARD SEED
7415212	--
7430000	VIOLA CREEK
7500000	JIM CREEK/HALLER PASS
7500301	HANK CREEK
7550000	EAST VALLEY
7810000	CAYADA CREEK
9031000	MASON LAKE TRAILHEAD
9035000	ASAHEL CURTIS
9040000	ALPENTAL

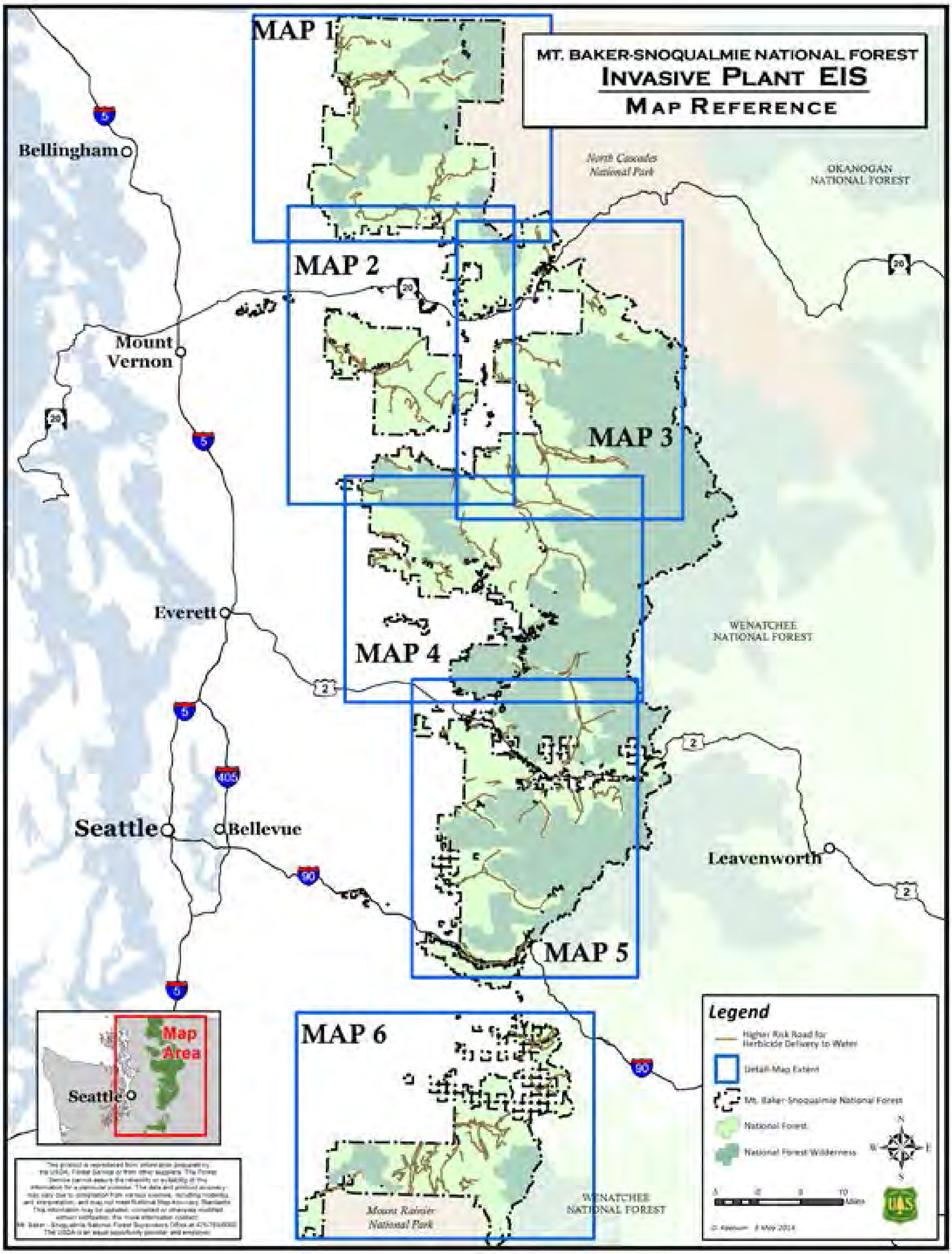

Figure D- 1. Invasive plant treatment project area overview map for roads with higher risk of herbicide delivery to fish-bearing streams

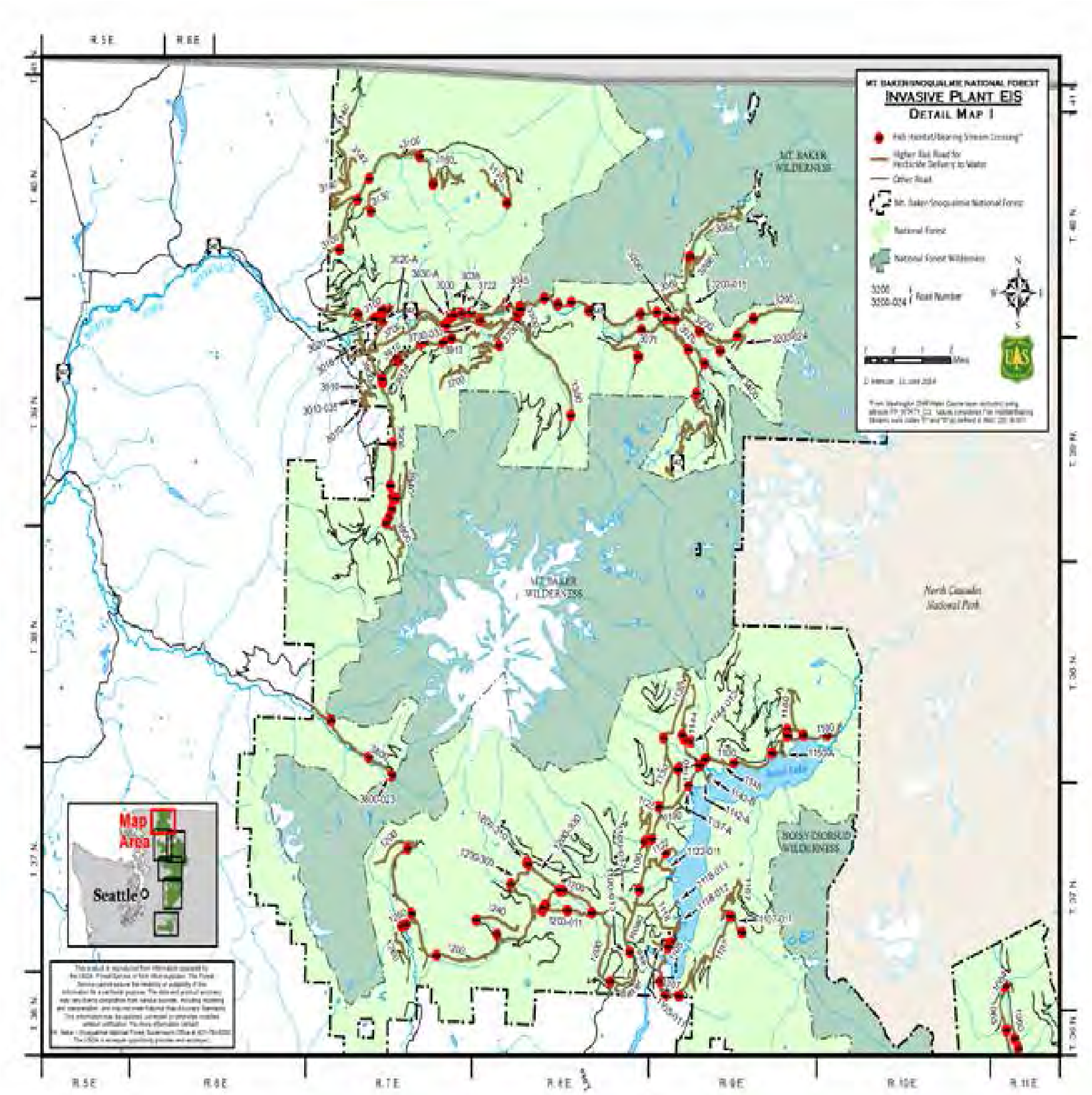

Figure D- 2. Roads with higher risk of herbicide delivery to fish bearing streams (map reference 1). Fish bearing stream road crossings are indicated

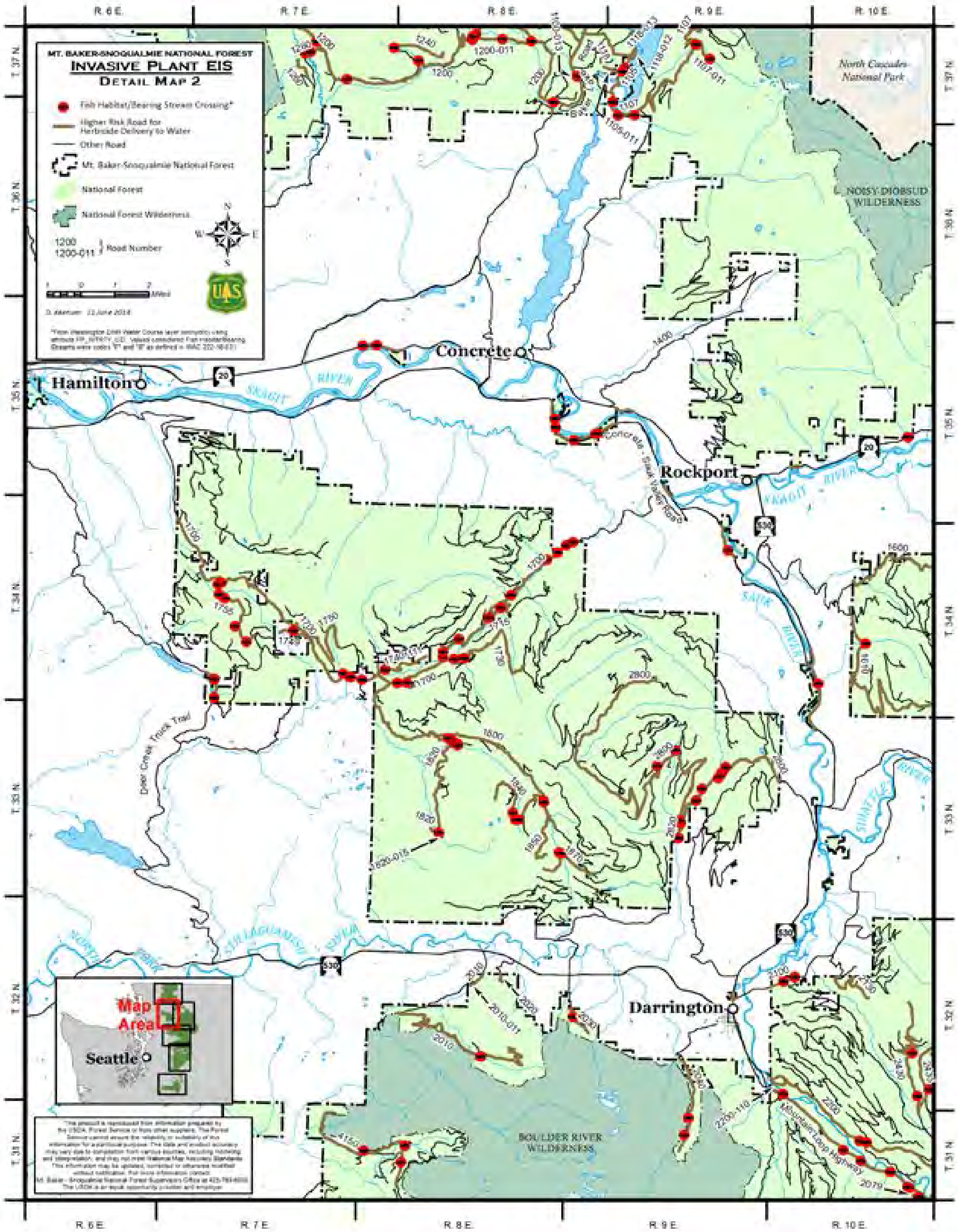

Figure D- 3. Roads with higher risk of herbicide delivery to fish bearing streams (map reference 2). Fish bearing stream road crossings are indicated

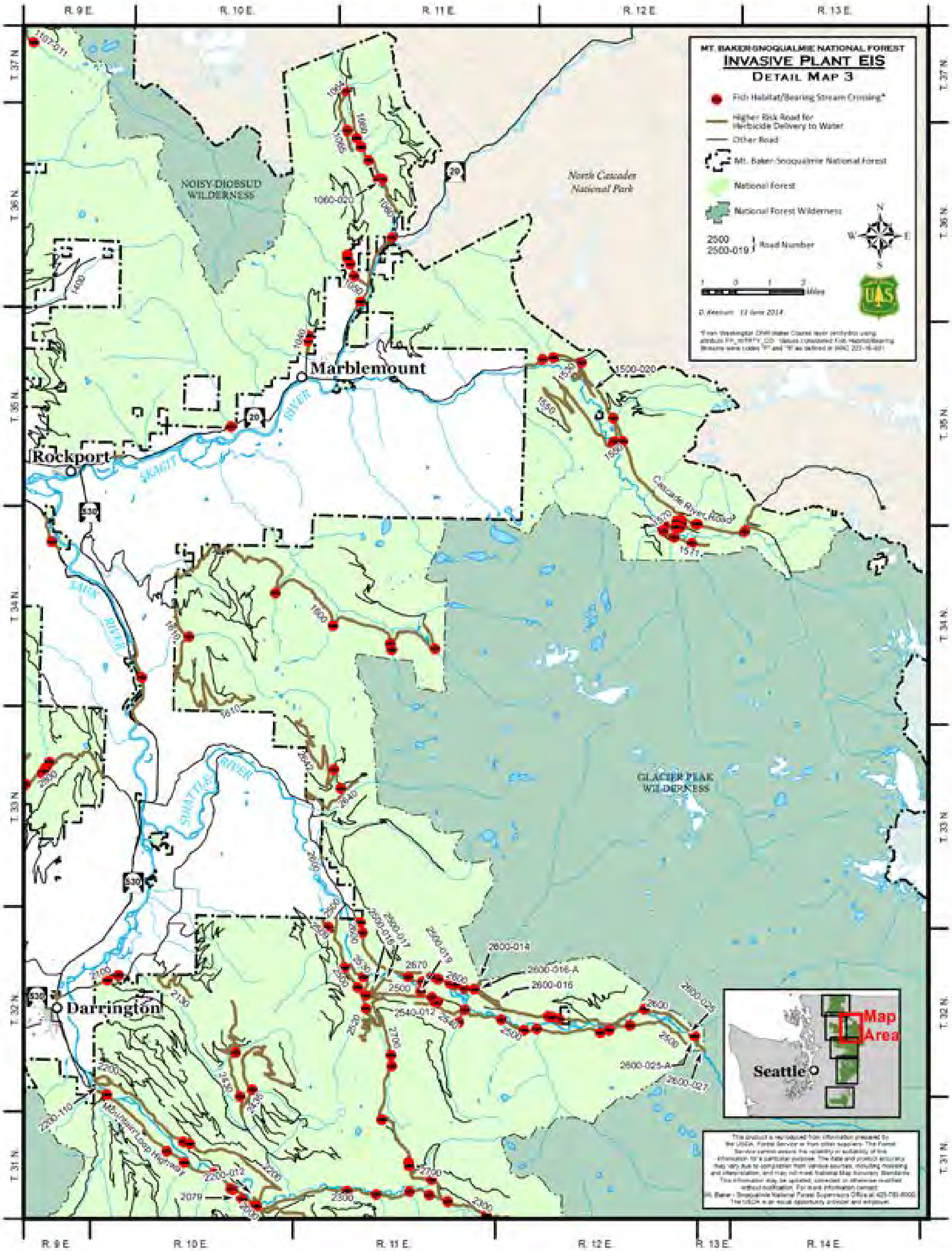

Figure D- 4. Roads with higher risk of herbicide delivery to fish bearing streams (map reference 3). Fish bearing stream road crossings are indicated

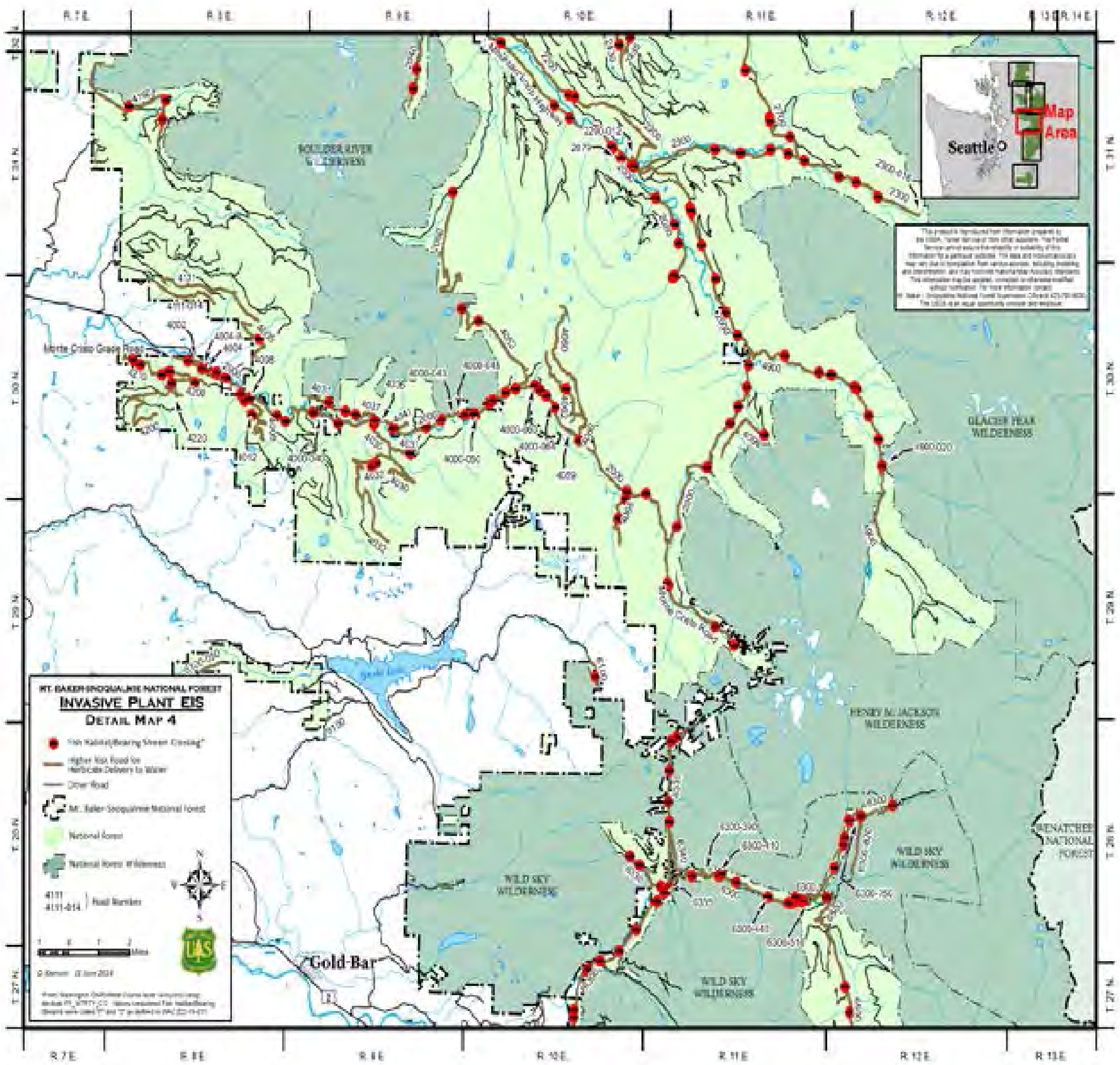

Figure D- 5. Roads with higher risk of herbicide delivery to fish bearing streams (map reference 4). Fish bearing stream road crossings are indicated

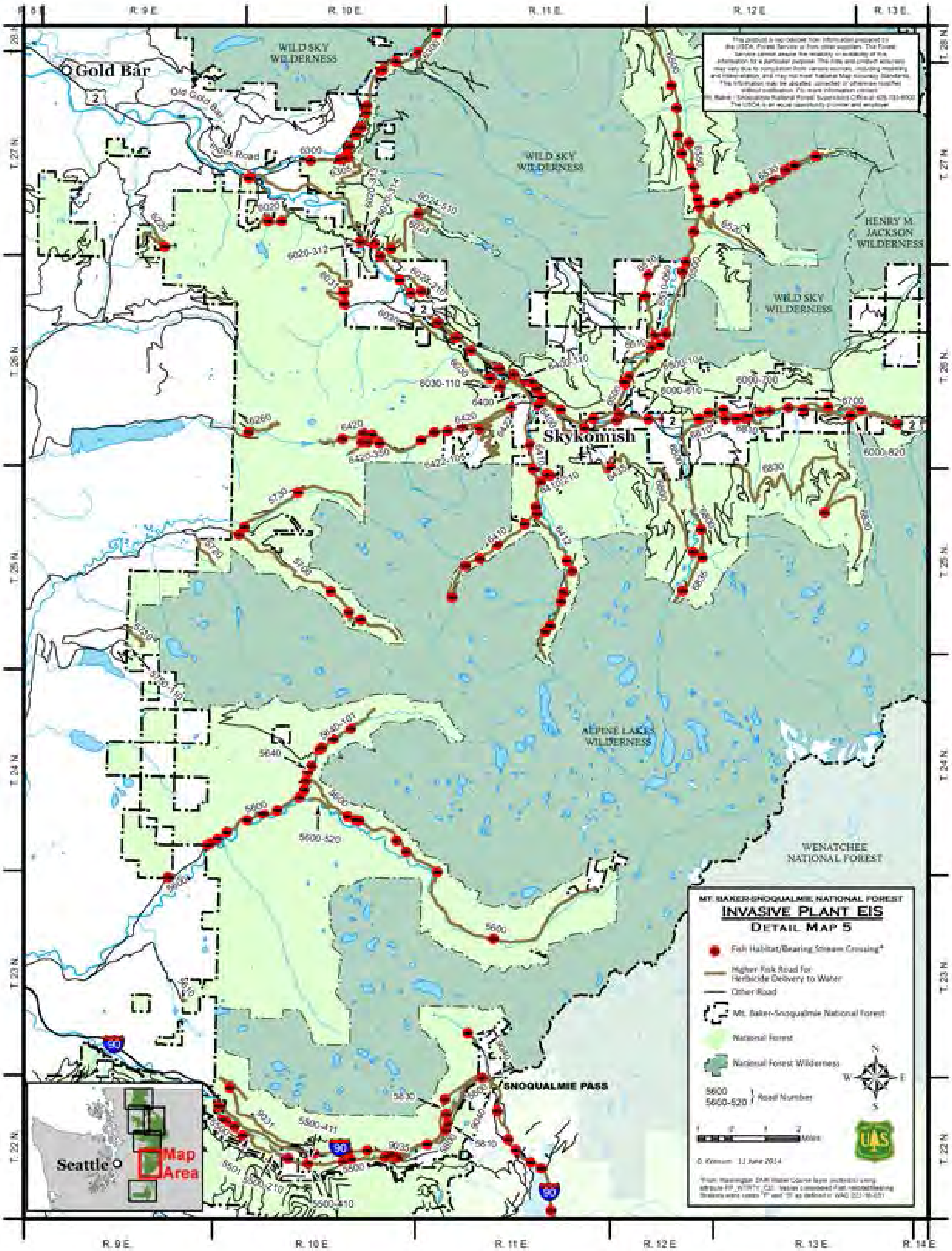

Figure D- 6. Roads with higher risk of herbicide delivery to fish bearing streams (map reference 5). Fish bearing stream road crossings are indicated.

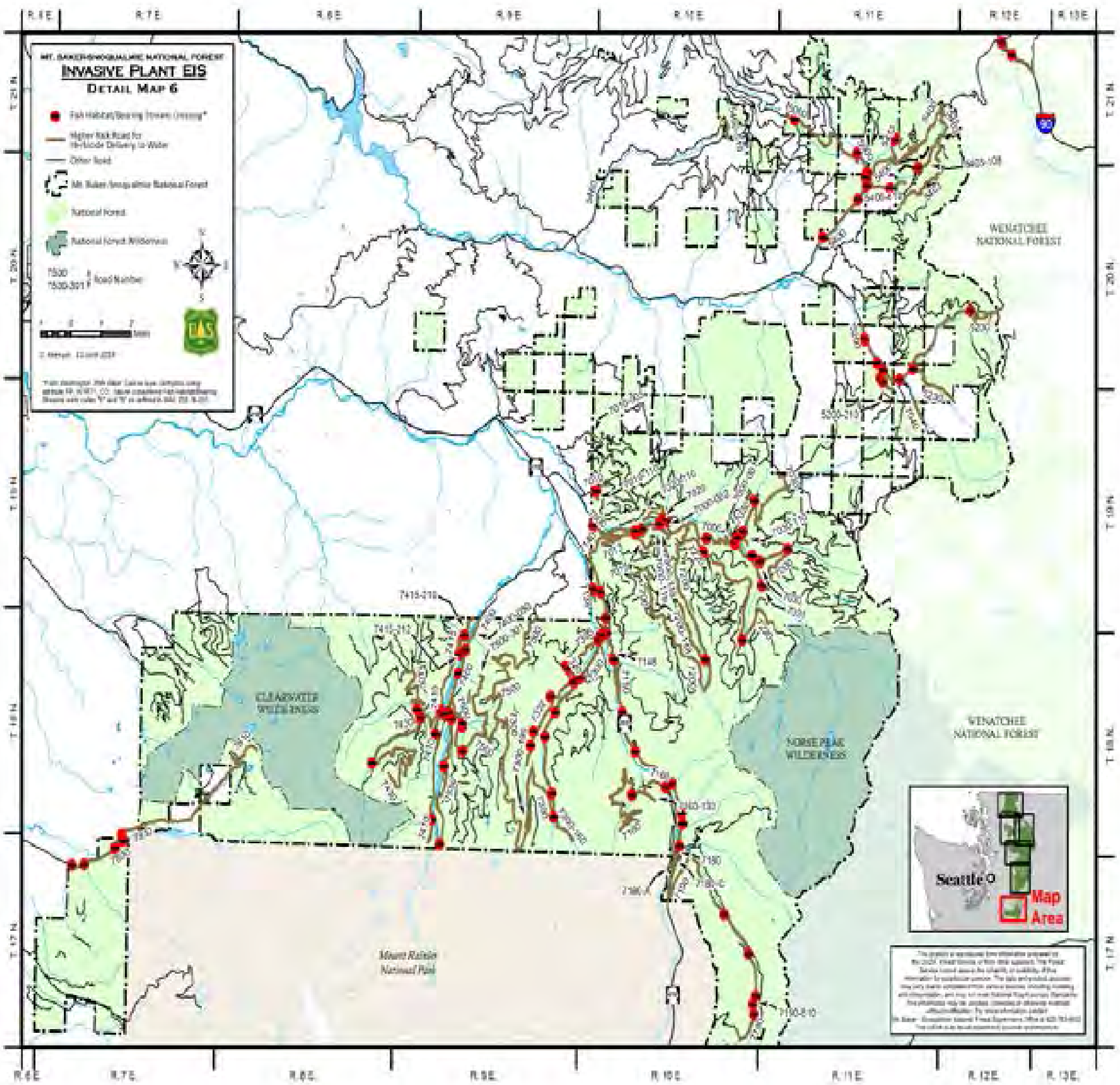

Figure D- 7. Roads with higher risk of herbicide delivery to fish bearing streams (map reference 6). Fish bearing stream road crossings are indicated

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Appendix E – Additives, Impurities And Inert Ingredients

Introduction

Inert compounds (inerts) 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. Impurities are inadvertent contaminants in the herbicide, usually present as a result of the manufacturing process.

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 (special purpose or utility modifiers). Surfactants are one type of adjuvant that makes the herbicide more effective by increasing absorption into the plant. Many of the inert ingredients are proprietary in nature and have not been tested on laboratory species. However, confidential business information (i.e. the identity of proprietary ingredients) was used this information in the preparation of the herbicide risk assessments.

The following types of surfactants have been reviewed in risk assessments and may be used to help herbicides adhere to target plants (Bakke 2003, 2007). Examples of trade names are also provided. Surfactants help reduce drift and abate risk of off-site movement of herbicides. The effects of using these ingredients, along with other inerts and metabolites, have been disclosed in the R6 2005 FEIS (Chapters 4.4, 4.5, 4.7 along with Appendices P and Q; and the Biological Assessment prepared for ESA consultation).

Limitations are proposed for use of some surfactants associated with potential adverse effects on human health, wildlife and aquatic ecosystem elements (see discussions in Chapter 3).

<u>Ethoxylated fatty amines (Cationic)</u>

- Entry™ II (Monsanto Company)

POEA (Polyethoxylated Tallow Amine - Roundup® (non-aquatic glyphosate) has 15% POEA. The POEA is associated with adverse effects on aquatic ecosystems. These risks are abated by project design criteria.

<u>Alkylphenol and Alcohol ethoxylate-based surfactants (non-ionic)</u>

- R-11® Spreader Activator (Wilbur-Ellis Company)
- Activator 90 (Loveland Industries)
- X-77® (Loveland Industries)
- Latron AG-98™ (N) (Dow AgroSciences LLC)
- Cide-kick®, Cide-kick® II™ (Brewer International)

These surfactants usually include an alcohol as a solvent (isopropanol (X-77®, AG-98™), butanol (R-11®, AG-98™ (N)), glycol (AG-98™ (N), Activator 90)), a silicone defoamer (polydimethylsiloxane), and water.

- Activator N.F. (Loveland Industries)

Nonylphenol Polyethoxylate (NPE) is a common non-ionic surfactant associated with some risks to human health and the environment. This ingredient would not be used on this project.

Silicone-Based Surfactants

- Sylgard® 309 (Wilbur-Ellis Company) –silicones
- Freeway® (Loveland Industries) –silicone blend
- Dyne-Amic® (Helena Chemical Company) - silicone blend
- Silwet L-77® (Loveland and Helena) - silicones

Also known as organosilicones, these are increasing in popularity because of their superior spreading ability. This class contains a polysiloxane chain. Some of these are a blend of non-ionic surfactants (NIS) and silicone while others are entirely silicone. The combination of NIS and a silicone surfactant can increase absorption into a plant so that the time between application and rainfall can be shortened. Blends normally include an alcohol ethoxylate, a defoamer, and propylene glycol.

Oils

Surfactants that are primarily oil-based have been gaining in popularity especially for the control of grassy weeds. Oil additives function to increase herbicide absorption through plant tissues and increase spray retention. They are especially useful in applications of herbicides to woody brush or tree stems to allow for penetration through the bark. Oil adjuvants are made up of either petroleum, vegetable, or methylated vegetable or seed oils plus an emulsifier for dispersion in water.

Vegetable oils

The methylated seed oils are formed from common seed oils, such as canola, soybean, or cotton. They act to increase penetration of the herbicide. These are comparable in performance to crop oil concentrates. In addition, silicone-seed oil blends are also available that take advantage of the spreading ability of the silicones and the penetrating characteristics of the seed oils.

The U.S. Food and Drug Administration (FDA) consider methyl and ethyl esters of fatty acids produced from edible fats and oils to be food grade additives (CFR 172.225). Because of the lack of exact ingredient statements on these surfactants, it is not always clear whether the oils that are used in them meet the U.S. FDA standard.

- MSO® Concentrate Methylated Seed Oil (Loveland Industries)
- Hasten® (Wilbur-Ellis Company)
- The surfactant in Pathfinder™ II (a triclopyr formulation)
- Improved JLB Oil Plus (Brewer International)
- Cide-Kick and Cide-Kick II (Brewer International)

Blends of vegetable oils and silicone-based surfactants

- Syl-tac™ (Wilbur-Ellis Company)
- Phase™ (Loveland Industries)

Crop oils and crop oil concentrates

These are normally derivatives of paraffin-based petroleum oil. Crop oils are generally 95-98 percent oil with 1-2 percent surfactant/emulsifier. Crop oils also promote the penetration of a pesticide spray.

Traditional crop oils are more commonly used in insect and disease control than with herbicides. Crop oil concentrates are a blend of crop oils (80-85 percent) and a nonionic surfactant (15-20 percent). The purpose of the nonionic surfactant in this mixture is to emulsify the oil in the spray solution and lower the surface tension of the overall spray solution. Kerosene is found in the triclopyr formulation Garlon IV. This formulation would not be broadcast nor used within 150 feet of surface water bodies or wetlands.

Adjuvants Approved For Aquatic Environments

Adjuvants that are approved for used in aquatic environments in Washington State (see Table E- 1 below) meet the following criteria:

- The product must fulfill all requirements for registration of a food/feed use spray adjuvant in Washington
- The spray adjuvant must be either slightly toxic or practically non-toxic to freshwater fish (such as rainbow trout, coho salmon or other cold water species)
- The spray adjuvant must be moderately toxic, slightly toxic or practically non-toxic to aquatic invertebrates (such as Daphnia spp.)
- The spray adjuvant formulation must contain less than 10 percent alkylphenol ethoxylates (including phosphate esters)

Herbicide applications within the aquatic influence zone for the MBS invasive plant treatment project would only include adjuvants that are approved for aquatic use in Washington.

Table E- 1. Adjuvants Approved for use in Aquatic Environments, Washington 2012

Product name	Registrant	Principal Functioning Agents	Acute toxicity - rainbow trout	Acute toxicity - daphnids
Agri-Dex	Helena Chemical Company	Petroleum oil, polyoxyethylene sorbitan fatty acid ester, sorbitan fatty acid ester	LC50 (96 hour) >1000 mg/l, Practically non-toxic	LC50 (48 hour) >1000 mg/l, Practically non-toxic
AquaSurf	Monterey AgResources	Petroleum oil, polyoxyethylene sorbitan fatty acid ester	LC50 (96 hour) >100 mg/l, Practically non-toxic	LC50 (48 hour) >100 mg/l, Practically non-toxic
Bond	CPS Loveland Products	Synthetic latex, alcohol ethoxylate	LC50 (96 hour) 190 mg/l, Practically non-toxic	LC50 (48 hour) 614 mg/l, Practically non-toxic
Bronc Max	Wilbur-Ellis Company	Ammonium sulfate, dodecylbenzene-sulfonic acid sodium salt, citric acid, dimethylpoly-siloxane	LC50 (96 hour) ≥100 mg/l, Slightly toxic to Practically non-toxic	LC50 (48 hour) >100 mg/l, Practically non-toxic
Bronc Plus Dry-EDT	Wilbur-Ellis Company	Ammonium sulfate, urea, polyoxyethylene-polyoxypropylene copolymer, citric acid, polyacrylamide, dimethylpoly-siloxane	LC50 (96 hour) 382.9 mg/l, Practically non-toxic	LC50 (48 hour) 223.6 mg/l, Practically non-toxic
Class Act NG	Winfield Solutions	Ammonium sulfate, saccharides, alkyl polyglycoside	LC50 (96 hour) 447 mg/l, Practically non-toxic	EC50 (48 hour) 377 mg/l, Practically non-toxic
Competitor	Wilbur-Ellis Company	Modified vegetable (seed) oil, polyethylene glycol fatty acid ester, polyoxyethylene sorbitan fatty acid ester	LC50 (96 hour) 95 mg/l, Slightly toxic	LC50 (48 hour) >100 mg/l, Practically non-toxic
Cut Rate	Wilbur-Ellis Company	Ammonium sulfate, citric acid	LC50 (96 hour) 782.2 mg/l, Practically non-toxic	LC50 (48 hour) 223.6 mg/l, Practically non-toxic
Cygnet Plus	Brewer International	Limonene, modified vegetable (seed) oil, alcohol ethoxylate	EC50 (96 hour) 45 mg/l, Slightly toxic	EC50 (48 hour) 6.6 mg/l, Moderately toxic
Destiny HC	Winfield Solutions	Modified vegetable (seed) oil, saccharides, sorbitan fatty acid ester	LC50 (96 hour) 21.71 mg/l, Slightly toxic	LC50 (48 hour) 28.63 mg/l, Slightly toxic
Dyne-Amic	Helena Chemical Company	Modified vegetable (seed) oil, polysiloxane polyether copolymer, alkylphenol ethoxylate	LC50 (96 hour) 23.2 mg/l, Slightly toxic	LC50 (48 hour) 60 mg/l, Slightly toxic

Product name	Registrant	Principal Functioning Agents	Acute toxicity - rainbow trout	Acute toxicity - daphnids
Exciter	CPS Western Farm Service	Ammonium sulfate, ammonium nitrate, alkyl polyglycoside	LC50 (96 hour) >100 mg/l, Practically non-toxic	EC50 (48 hour) 7.7 mg/l, Moderately toxic
Fraction	Kalo	Ammonium sulfate, citric acid	LC50 (96 hour) 782.2 mg/l, Practically non-toxic	LC50 (48 hour) 223.6 mg/l, Practically non-toxic
InterLock	Winfield Solutions	Modified vegetable (seed) oil, polyoxyethylene sorbitan fatty acid ester, vegetable (seed) oil	LC50 (96 hour) >100 mg/l, Practically non-toxic	LC50 (48 hour) >100 mg/l, Practically non-toxic
Kinetic	Helena Chemical Company	Polysiloxane polyether copolymer, polyoxypropylene-polyoxyethylene copolymer	LC50 (96 hour) 13.9 mg/l, Slightly toxic	LC50 (48 hour) 60.7 mg/l, Slightly toxic
Level 7	Winfield Solutions	Ammonium sulfate, citric acid, saccharides	LC50 (96 hour) >100 mg/l, Practically non-toxic	EC50 (48 hour) >100 mg/l, Practically non-toxic
LI 700	CPS Loveland Products	Lecithin, propanoic (propionic) acid, alkylphenol ethoxylate	LC50 (96 hour) 130 mg/l, Practically non-toxic	LC50 (48 hour) 170 mg/l, Practically
Liberate	Loveland Products	Lecithin, alcohol ethoxylate, modified vegetable (seed) oil.	LC50 (96 hour) 17.6 mg/l Slightly toxic	EC50 (48 hour) 9.3 mg/l. Moderately toxic
Magnify	Monterey AgResources	Ammonium sulfate, ammonium nitrate, alkyl polyglocoside.	LC50 (96 hour) > 100 mg/l, Practically non-toxic	EC50 (48 hour) 7.7 mg/l. Moderately toxic
One-AP XL	Kalo	Ammonium sulfate, urea, polyoxyethylene-polyoxypropylene copolymer, citric acid, polyvinyl polymer (polyacrylamide), dimethylpoly-siloxane	LC50 (96 hour) 382.9 mg/l, Practically non-toxic	LC50 (48 hour) 223.6 mg/l, Practically non-toxic
Pro AMS Plus Activator Penetrant	IAP	Ammonium sulfate, ammonium nitrate, alkyl polyglycoside	LC50 (96 hour) >100 mg/l, Practically non-toxic	EC50 (48 hour) 7.7 mg/l, Moderately toxic
Sinker	Helena Chemical Company	Polyvinyl polymer (Polyacrylamide), alkylphenol ethoxylate, sorbitan fatty acid ester	LC50 (96 hour) 750 mg/l, Practically non-toxic	LC50 (48 hour) >1000 mg/l, Practically non-toxic
Spray-Rite	J R Simplot	Ammonium sulfate, citric acid	LC50 (96 hour) 782.2 mg/l, Practically non-toxic	LC50 (48 hour) 223.6 mg/l, Practically non-toxic

Product name	Registrant	Principal Functioning Agents	Acute toxicity - rainbow trout	Acute toxicity - daphnids
Superb HC	Winfield Solutions	Petroleum Oil, saccharides, polyoxyethylene, sorbitan fatty acid ester	LC50 (96 hour) 45.0 mg/l, Slightly toxic	LC50 (48 hour) >1004 mg/l, Practically non- toxic
Tactic	CPS Loveland Products	Synthetic latex, propylene glycol, alcohol ethoxylate, polysiloxane polyether copolymer	LC50 (96 hour) >100 mg/l, Practically non-toxic	EC50 (48 hour) 310 mg/l, Practically non-toxic
Tronic	Kalo	Vegetable (seed) oil ethoxylate, tall oil fatty acids	LC50 (96 hour) >200 mg/l, Practically non-toxic	EC50 (48 hour) 28.9 mg/l, Slightly toxic

Appendix F - Recently Completed, Currently Being Implemented, Ongoing and Foreseeable Future Projects

Table F- 1. Cumulative effects projects – recently completed projects (2010-2014) with overlap of invasive plant action area

Recent Past Project Name	Project Type/Could this type of project contribute to invasive plant spread?	Project Description	When Completed	General Location/ TRS/ and invasive plant Treatment Analysis Area
Baker Lake ATM Road System	Restoring roads and landings/ closing roads/yes	Decommission, close, seasonally close, or upgrade various portions of the 1100 and 1106 road system.	2011	Baker Lake watershed, Sandy Creek and Rocky Creek T37N, R8E and T37N, R9E. TAA #43.
WSDOT Pedestrian Walkway and Turn Lane	Roads (maintenance, construction, reconstruction and use)/yes	Construction of a turn lane and pedestrian bridge on and over US 2 at crest of Stevens Pass	2011	Stevens Pass Ski Area, ~12 miles E of Skykomish in Tye River watershed. TAA #15.
White Chuck – ERFO Road Repair	Roads (maintenance, construction, reconstruction and use)/yes	Repair 2003 and 2006 flood damage to Road 23; decommission upper portion of Road 23	2010	Road 23 T31N; R11E; Sec. 13-18 T31N; R12E; Sec. 19. TAA #26
Road 1106 Reroute and decommission	Closing roads/yes	Decommissioned 0.34 mile of Road 1106 and rerouted dam access road on Road 1112 and 015 spur, with 500 ft. of connector road.	2010	Between Komo Kulshan guard station and Baker Lake/ T37N, R8E, TAA #43.
Troublesome Creek Bridge Replacement	Roads (maintenance, construction, reconstruction and use)/ no	Replace flood damaged bridge	2013	T28N; R11E; Sec. 21 TAA#19
Road 11 Sulphur Creek Bridge Replacement	Roads (maintenance, construction, reconstruction and use)/ yes	Whatcom County bridge replacement project.	2011	Baker Lake, Komo Kulshan vicinity. T37N, R8E, sec PB42. TAA #43. .
Relocate road 542	Roads (maintenance, construction, reconstruction and use)/ yes	Relocate road away from high erosion area, replace existing culvert with bridge	2010	T40N; R7E; Sec. 36 TAA #45
WSDOT US 2 Slope Stabilization	Road maintenance/yes	Project activities include: scaling, trim blasting, installation of rock bolts, rock dowels, cable net, and shotcrete, installation of horizontal drains with slotted PVC pipe and removal of hazard trees along the slope crest and existing rock slope face	2013	~10 miles east of Skykomish, Tye River watershed. US 2 – Section 1 (MP 62.60 – 63.00), Section 2 (MP 63.00 – 63.20), Section 3 (MP 63.90 – 64.10). TAA # 15.

Recent Past Project Name	Project Type/Could this type of project contribute to invasive plant spread?	Project Description	When Completed	General Location/ TRS/ and invasive plant Treatment Analysis Area
Mountain Loop Marten Creek Buttress	Roads (maintenance, construction, reconstruction and use)/no	remove and replace existing buttress with benched in buttress	2010	T30N; R9E; Sec. 23 SE ¼ TAA#23
Excelsior Campground Road Reconstruction	Roads (maintenance, construction, reconstruction and use)/yes	build 380' long bypass road, reconfigure existing road, parking areas and turnaround area	2012	T40N; R8E; Sec. 31 SE ¼ SW ¼ TAA#41
Road 39 (Glacier Ck Rd)	Roads (maintenance, construction, reconstruction and use)/yes	Repair 60' of road damaged due to slide	2013	T39N; R7E; Sec. 21 TAA #44
Forgotten Thin Plus	Vegetation management/yes	400 acres of thinning, no riparian treatment	2013	Sauk River watershed T31N; R10E; Secs. 13 TAA #25) , 23-25 (TAA #24) T31N; R11E; Secs. 30-32. (TAA #24)
PSE Pole Replacement	Vegetation Management/yes	Replacement of two utility poles; necessitated relocating the alignment further from White River and cutting ~50 trees.	2010	Adjacent to White River. T19N, R10E, Secs. 30 & 31. TAA#4.
Baker Lake Resort Redevelopment (Swift Creek Campground)	Recreation/yes	Decommission Baker Lake Resort and construct 30-50 unit campground	2011	Northwest shore of Baker Lake T37N, R9E, Sec. 5. TAA #43.
Old Sauk Trailheads and Trail Reconstruction	Recreation/yes	reconstruct 2 trailheads and construct barrier free interpretive trail loop, additional parking, toilets and trailhead facilities	2012	T31N; R10E; Secs. 4, 5 & 9 TAA#27 T32N; R10E; Sec. 31 TAA#27
Stevens Pass Ski Area Master Development Plan Phase I	Recreation/yes	Construct ~7.2 miles of mountain bike trails and replace existing water treatment facility at Ski Area. Partially complete, continuing implementation	2012	~12 miles E of Skykomish in Tye River watershed T26N; R14E; Secs. 13 & 14. TAA #15.

Table F- 2. Ongoing/Current Projects that Overlap Treatment Analysis Areas

Currently Being Implemented or Ongoing Project Name	Project Type/Could this type of project contribute to invasive plant spread?	Project Description	Currently In Progress or Ongoing Project	General Location/ TRS/ and invasive plant Treatment Analysis Area
Apex Mine Mill Site	Mining & geothermal / Yes	Reopen portal & mine ore	In progress	South Fk Skykomish River watershed. Mill: T26N; R11E; Sec.21.TAA #20.
Campground Rental and Maintenance	Recreation / yes	Maintenance activities associated with rental of campgrounds located on NFS lands	Ongoing	Buck Creek CG T32N; R11E: Sec 13 TAA #32). Sulphur Creek CG T32N; R12E; Sec. 24 (TAA #53). Suiattle Guard Station T32N; R11E; Sec. 18 (TAA #33).
Monte Cristo CERCLA Clean-up	Recreation and administrative sites/yes	superfund site – clean up at mining town site reconstruct 4.5 miles of road to site	In progress	T29N; R11E; Sec. 21 TAA#47
Mt Loop Gateway & Beaver Lake Trailhead Enhancement	Recreation/ yes	Construct visitor info station and reconstruct Beaver Lake Trailhead and trail. Install interpretive signs	In progress	T31N; R10E; Secs. 5 & 14 TAA #27
Baker Lake Dispersed Campsite Hardening	Recreation/ yes	Plan to harden 3-6 dispersed campsites on both sides of Baker Lake, various locations, including parking spot hardening (mitigation measure for Baker Lake Hydro relicense).	In progress	Various locations on Baker Lake. TAA #43.
White River Recreation Residence Well and Septic SUPs	Recreation/ yes	Install community well and septic systems for existing recreation residences in Silver Creek vicinity	In progress	Hwy 410, Silver Springs Campground. TAA #5.
Kelly Creek Horseshoe Tunnel Trail	Recreation/ yes	Relocate Kelly Creek TH and construct 3.0 miles of trail	In progress	T26N; R12E; Secs. 12, 13, 24 T26N; R13E; Sec. 18 TAA# 15
Stevens Pass Ski Area Master Development Plan Phase II	Recreation/yes	Additional lift development and base area facilities; new mountain bike trails and parking facilities	In progress	~12 miles east of Skykomish in Tye River watershed. TAA #15.
Excelsior Campground Maintenance	Recreation/yes	Vegetation brushing, cleaning, painting, and hazard tree removal	Ongoing	Mt Baker Hwy, Excelsior Campground. T40N; R8E; Sec. 31. TAA #45.
Crystal, Stevens Pass, The Summit, Mt Baker Ski Area Maintenance	Ski Area/yes	Parking lot maintenance, snow remove, ditchline cleaning, construct waterbars, clear ski runs, vegetation management	Ongoing	T24N; R14E; Secs. 13 & 14 No TAA T23N; R11E; Secs. 29, 32 & 33 TAA#11 T22N; R11E; secs. 4, 16 & 22 TAA#11 T39N; R9E; Secs. 18-20 No TAA T26N; R13E, Sec.14-15, 22-23

Currently Being Implemented or Ongoing Project Name	Project Type/Could this type of project contribute to invasive plant spread?	Project Description	Currently In Progress or Ongoing Project	General Location/ TRS/ and invasive plant Treatment Analysis Area
				TAA#15 T17N; R10E; sec 19&30 TAA#06 T17N; R11E secs. 24-26 TAA#06
SF Snoqualmie Road Storage	Road closures/ yes	Convert 20.5 miles of road to trails; Store 2.7 miles; reduce 2.1 miles from ML 3 to ML 2; construct 0.96 mile of new trail	Ongoing	T22N; R9E Secs. 1-4, 9, 10, 12 & 13 TAA#11 T22N; R10E; Secs. 7,8,15, 17-22 & 27-29 TAA#11
South Fork Skykomish Road Decommission	Road closure/ yes	Decommission ~18 miles and close ~19 miles of roads in the South Fork Skykomish drainage	In progress	Lower Beckler, Miller and Foss watersheds. TAAs #16,20,49.
Suiattle Access and Travel Management	Road closure/ yes	Maintain 66 miles of road as open, close 23 miles of road, and decommission 51 miles of road	In progress	Suiattle River watershed. TAA #41.
SF Skykomish Roads	Road closure/ yes	store 14 miles of road decommission 19 miles of road (road 6025 and its spurs, spurs off of roads 6020, 6024, 6030, 6835, & 6846)? Other TRS?	In progress	T27N; R10E T26N; R10E T26N; R11E T26N; R12E TAA#20, TAA#49
Grizzly bear closures	Road closures/ yes	Decommission Road 1107 and spurs to expand core habitat (measures for Baker Lake Hydro relicense).	In progress	East side of Baker Lake, TAA #43.
ERFO Road Repair	Roads -Restoring roads and reconstruction / yes	Repair 2006 flood damage to Road 26 at several mileposts. Includes reroute using Road 2670.	On-going	Lower Suiattle Watershed. T32N, R11E. TAA #32 and 33.
Annual Road and Trail Maintenance	Roads (maintenance, construction, reconstruction and use). yes	Routine road and trail maintenance on open roads and accessible trails in watershed Road maintenance work (brushing, blading, grading) on Road 26. Rock Pit maintenance.	Ongoing-Occurs annually. Brushing every 3 years; Glade and blade 2 times per year	Suiattle River watershed. T33 N, R10 and 11 E. T 32N, R11 and 12E. Forest Road 26 and vicinity. TAA #33.

Currently Being Implemented or Ongoing Project Name	Project Type/Could this type of project contribute to invasive plant spread?	Project Description	Currently In Progress or Ongoing Project	General Location/ TRS/ and invasive plant Treatment Analysis Area
Annual Road Maintenance	Roads (maintenance, construction, reconstruction and use)/ yes	Highway 410 maintained by WA Dept. of Transportation and Crystal Mountain Blvd maintained by Pierce County, with Crystal Mountain Ski Area responsible for snow removal Forest Roads maintained by MBS. Maintenance may include culvert and ditch cleanout, surface blading, and vegetation clearing within the rights-of-way.	Ongoing-Occurs annually	Highway 410, Crystal Mountain Boulevard, and Forest Road segments within project area. TAA #6.
Waldheim Slide	Roads (maintenance, construction, reconstruction and use)/yes	road repair & slide restoration	Repair complete – restoration is In progress	T30N; R9E; Sec. 23 TAA#23
Canyon Creek Rd Repair and Storage	Roads (maintenance, construction, reconstruction and use)/yes	Upgrade road 31 to MP 8.4, improve drainage Rd 4140 to MP 1.7, and place approx. 16 miles of road in storage	In progress	T31N; R8E; TAA#23
Silver Springs Campground Fish Passage Culvert Replacement	Stream restoration/ yes	Replace existing corrugated metal pipe with open bottom arch culvert under campground loop road to improve fish passage	In progress	Hwy 410, Silver Springs Campground. TAA #5.
Sulphur Creek Hatchery Slide	Stream restoration/ yes	Slope stabilization	In progress	T37N: R9E; Sec 31 TAA#43
Spawning Beach Decommission	Stream restoration/ yes	Removing all concrete pool structures, asbestos piping, and pumphouse; recontour area to be a natural stream channel (mit. measure for Baker Lake Hydro relicense).	In progress	At headwaters of Baker Lake, below mouth of river, past Channel Creek T38N; R25E; Sec. 25 SE ¼ and Sec. 36 NE ¼. TAA #43.
Beckler Thin (two sakes: Johnson Creek and 4th of July	Vegetation Management And Road closure/ yes	Commercial thinning of ~797 acres; regeneration harvest of ~117 acres, decommissioning (as needed) and removal of FS Roads 6546-110 (1.0 mile), 6548-110 (2.45 miles), 6560 (1.2 miles), and restoration of fish passage at Road 65 (MP 5.0, 5.23, and 5.4)	In progress	N and NE of Skykomish. T28N, R12E; Sec. 31. T26N, R11E; Sec. 13 & 24. T26N, R12E; Secs. 5, 18 & 19. T27N, R12E, Secs. 6, 7, 16,17, 19,20, 29, 32. TAAS #16 and 17.

Currently Being Implemented or Ongoing Project Name	Project Type/Could this type of project contribute to invasive plant spread?	Project Description	Currently In Progress or Ongoing Project	General Location/ TRS/ and invasive plant Treatment Analysis Area
Upper White River Vegetation Management Two sales: White Water and Thirsty Mule	Vegetation Management/ yes	Commercial variable-density thinning on ~1,962 acres of under-80-year-old conifer stands in the Huckleberry Creek and West Fork White River watersheds. Total thinned area ~1,413 acres (excluding buffers)	White Water is In progress Thirsty Mule soon to be advertised	West Fork White River and Huckleberry Creek watersheds. TAA #2. T18N, R9E, Secs. 1, 3,8-10, 12-14, 15-17, 20 & 21. T10N, R10E, Secs. 6, 7 & 18. TAA # 2.
Kaaland Restoration	Vegetation management/ No because invasive plant treatment is part of project	increase riparian forest, diversity of ungulate forage, reduce noxious weeds	In progress	T35N; R5E; Sec. 26 NW ¼ & NW ¼ of SW ¼ T35N; R5E; Sec. 27 E ½ of NE ¼ TAA#36
I-90 Corridor thin	Vegetation management/ Yes	Commercially thin 350 acres (348 acres commercial thin 2 acres clear cut) construct 1.5 miles of temporary roads	In progress	T22N; R9E; Sec. 1 & 12 T22N; R10E; Secs. 5,6, 7, 9-11, 14 & 15 TAA#11
Dan Thin Timber Sale	Vegetation management/ Yes	Commercially thin 238 acres	In progress	T32N; R10E; Secs. 16, 20, 21, 27 & 28' TAA#48 & TAA#30
Greenwater Elk Forage Management Project	Vegetation management/ Yes	135 acre clear cut for forage opening	In progress	T19N; R9E; Secs. 13, 14 & 21 TAA#3 T19N; R10E; Secs. 16-23 & 31 TAA#3 & TAA#4
Gov't Meadows (Muckleshoot Tribe) Huckleberry Enhancement CCS	Vegetation management/ Yes	thinning approx. 47 acres to promote huckleberry enhancement and planting of huckleberry and other native shrubs	In progress	T19N; R11E; Sec. 33 TAA#3
Decline Thin	Vegetation Management/ yes	400 acres of thinning	In progress	T32N; R10E; Secs. 22, 23 & 27. TAA# 30

Table F- 3. Foreseeable Future Projects that Overlap with Invasive Plant Treatment Analysis Areas

Foreseeable future Project Name	Project Type/Could this type of project contribute to invasive plant spread?	Project Description	Foreseeable Implementation Time Frame	General Location/ TRS/ and invasive plant Treatment Analysis Area
Camp Silverton Building Removal & Permit Termination	Recreation and administrative sites/yes	remove buildings from Camp Silverton	2014-2015	T30N; R9E; Sec. 23 TAA#23
Crystal Mountain Master Development Plan Amendment #1	Recreation/ yes	Replace the High Campbell chairlift;	2014-2108	Crystal Mountain Ski Area T17N; R10E; Sec. 24. TAA #6.
Upper Baker Visitor Information Services	Recreation/ yes	Construct visitor information station with existing parking and add kiosks and restrooms.	2014-2015	Near Komo Kulshan Guard Station, Baker lake area, TAA #43.
Bayview Campground Redevelopment	Recreation/ yes	Rehabilitate 28 unit fee campground.	2014-2015	On west shore of Baker Lake; TAA #43.
Hwy 542 recreation enhancements	Recreation/ yes	improve trail from parking area to NF Nooksack river, install interpretive signs, restroom remodel, install CXT toilet, place barrier rocks	2014 -2015	T39N; R7E; Sec. 3 TAA#45
Panorama Boat Ramp Reconstruction and Parking lot expansion	Recreation/ yes	pave and redo boat ramp subgrade add 10-15 vehicle and boat parking spaces	2015	T37N; R9E; Sec. 5. TAA#43
Road 2540 Removal	Road closure/ yes	Decommission first 1.23 miles after Marsh Pond treatment	2014-2015 T32N, R11E Secs. 14 & 23	Marsh Pond, Suiattle River drainage. TAA #32.
PSE Greenwater Electric System SUP Renewal	Road closure/ yes	convert overhead electric distribution to underground distribution system, decommission road 7300-101 on both sides of washout and 0.5 mile of road 7190	2014	T19N; R10E; Sec. 30 TAA#4 TAA#3 T18N; R10E; Secs. 5-8, 17, 20, 21,27, 28, 34, & 35 TAA#4, TAA#5 T17N; R11E; Sec. 19 & 30 TAA#6

Foreseeable future Project Name	Project Type/Could this type of project contribute to invasive plant spread?	Project Description	Foreseeable Implementation Time Frame	General Location/ TRS/ and invasive plant Treatment Analysis Area
Index/Galena County Road Flood Repair	Roads (maintenance, construction, reconstruction and use)/ yes	Snohomish County to reconstruct flood damaged sites on Road 6300	2014 possible start	~3 miles north of South Fork Skykomish drainage in North Fork Skykomish River watershed. TAA #19.
Crystal Mountain Boulevard Resurfacing	Roads (maintenance, construction, reconstruction and use)/ yes	Resurfacing of Crystal Mountain Boulevard to repair weather and traffic related damage. Project would also include the repair of damaged guard rails, the replacement of worn culverts, rockslide protection, and replacement of 96-inch-diameter culverts with concrete box culverts	2014	Crystal Mountain Boulevard from Highway 410 to the Crystal Mountain Ski Area. TAA #6.
Suiattle Rd ERFO 6.0-14.4	Roads (maintenance, construction, reconstruction and use)/yes	Remove debris, excavate and construct embankment, place aggregate base and asphalt surfacing, place topsoil, seed, and mulch on disturbed areas	2014-2015	T32N; R11E TAA#33 & TAA#32
Marsh Pond Fish Passage Restoration	Stream restoration/ yes	Remove outdated fish ladder, modify berm at outlet of Marsh Pond and outlet channel to improve fish passage.	2014-2015	Marsh Pond, Suiattle River drainage. T32N, R11E, Sec.14. TAA#32.
Finney AMA Timber Project	Vegetation management/ yes	1,256 acres commercial thinning in 39 stands, 6 miles road re-opened, 54 miles reconstruction, 4.6 miles temporary road, 3.6 miles road decommissioning	2014 – 2016	Finney Creek drainage, tributary to Skagit River T34N, R8E, Secs. 2, 3, 10, 11, 14, 15, 19-22, & 26-33. TAA #38.
Suiattle Seed Orchard Plantings	Vegetation management/ Yes	Maintain/replant 5 acres of plantings in eroded riparian reserves	2014-2015	T32N; R11E; Secs. 9 & 16. TAA #32.
Snoqualmie Point	Vegetation management/ Yes	clearcut and commercial thin	2014	T23N; R7E; sec 1 T23N; R8E Sec. 6 TAA#14

Foreseeable future Project Name	Project Type/Could this type of project contribute to invasive plant spread?	Project Description	Foreseeable Implementation Time Frame	General Location/ TRS/ and invasive plant Treatment Analysis Area
Hansen Creek Timber/Veg Mgmt	Vegetation management/ Yes	1800 acres timber management includes clearcut, thinning and pre-commercial thinning	2015-2018	T23N; R9E; Secs. 34 & 35 T22N; R9E; Secs. 1, 2 & 12 T22N; R10E; Secs. 6-18 TAA#11
Upper White River Vegetation and Restoration Project	Vegetation management/yes	Commercially thin about 1,400 acres, change use level on 7.6 miles of road, decommission 13 miles of road.	Start planned for 2014 and continue for about 5 years	West Fork White River watershed.

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Appendix G – Invasive Plant Treatment DEIS Comments and Forest Service Responses

Summary of Comments Received

The Forest Service received 18 individual pieces of correspondence (table G- 1) in response to distribution of the Draft EIS for comment. Of the 18, the content of the first 4 were questions or requests that did not contain comments. Two letters containing comments were received from federal agencies, two letters containing comments were received from county agencies, one letter containing comments received from the city of Seattle, three letters containing comments were received from various environmental interest groups, and six letters containing commenter were from individuals. The letters from agencies are reproduced in total and the other letters are in the project record and available on request.

Table G- 1. List of commenters

ID #	Name	Organization
01	Dick Artley	
02	Eileen Maloney	
03	William (Bill) Lider	
04	Kathy Johnson	
05	Matt Bell	
06	Eric Olsen	
07	Ben and Nancy Brodie	
08	Dennis Clark	
09	Brooke Thompson	
10	Sally Nickerson	City of Seattle
11	Dick Artley	
12	Steve Burke	King County
13	Scott Moore	King County Weed Board
14	Rebecca Chaney	Washington Native Plant Society
15	Mark Boyar and others	Middle Fork Coalition and others
16	Megan Dunn and others	Northwest Coalition for Alternatives to Pesticides and others
17	Allison O’Brien	Department of the Interior
18	Christine Reichgott	Environmental Protection Agency

The comments generally cover the following topic areas:

1. Concern about the risks to public and applicator health from chemical use
2. Concern about the effectiveness of the proposed action and alternatives in treating invasive plants
3. Concern about how ongoing land uses may result in the spread of invasive plants

Comments and written responses are shown in Table G- 2 below.

Comment Response Regulations

The NEPA regulations at 40 CFR 1503.4a require that an agency preparing a final environmental impact statement shall assess and consider comments both individually and collectively, and shall respond by one or more of the means listed below, stating its response in the final statement. Possible responses are to:

1. Modify alternatives including the proposed action.
2. Develop and evaluate alternatives not previously given serious consideration by the agency.
3. Supplement, improve, or modify its analyses.
4. Make factual corrections.
5. Explain why the comments do not warrant further agency response, citing the sources, authorities, or reasons which support the agency's position and, if appropriate, indicate those circumstances which would trigger agency reappraisal or further response.

New or Modified Alternatives

The following were suggestions provided by commenters for new alternatives or modifications of alternatives. The suggestions for new alternatives or modifications to existing alternatives were generally intended to reduce herbicide use or exposure.

1. Treat these plants with a more costly, safer alternative–mechanical and biological means.
2. The “No Action” alternative should compare the action alternatives to a true “no action” alternative, where no chemical herbicide weed control measures are used.
3. Analyze a 4th action alternative in detail that would prohibit glyphosate application anywhere on the forest for any reason.
4. The DEIS should examine other alternatives that would use non-herbicide methods first.

These comments were considered and found to not warrant agency response with the development of new or modified alternatives, based on the following information provided in the DEIS. See DEIS Chapter 2.6 for alternatives considered and information about those not developed in detail.

Non-herbicide methods are used, and would continue to be used under all alternatives. Our experience implementing the current program, along with information in the R6 2005 FEIS and in the 2007 Aminopyralid Risk Assessment, prompted the Forest Service to seek additional tools to improve the cost-effectiveness of treatment.

A No-Action Alternative with no chemical treatment would not meet the purpose and need of the project to respond with timely containment, control and/or eradication of invasive plants. FSH 1909.15 Chapter 14.2 discusses two interpretations of “no action”, including the case where no action equates to no change from current management direction or level of management intensity. As noted in CEQ's 40 most asked questions: "To construct an alternative that is based on no management at all would be a useless academic exercise. Therefore, the "no action" alternative may be thought of in terms of continuing with the present course of action until that action is changed." Thus, in the present EIS, the no-action alternative would continue the present treatment approach. A no herbicide alternative was considered and rejected in the MBS 2005 DN.

Some of the comments suggested alternatives that would remove tools from the existing toolbox or impose greater restrictions on herbicide use than are necessary to follow Forest Service policies and the MBS Forest Plan. Alternatives that would have avoided use of all or specific herbicides were considered, but not further developed for detailed study as per the discussion in Chapter 2.6.3 – page 52 of the DEIS. Alternatives that would remove tools or otherwise would decrease cost-effectiveness would not meet the purpose and need and are properly not considered in detail. The analysis in the DEIS and our experience with treating invasive plants has not indicated a need to remove chemicals from the toolbox.

One commenter provided several pages of linked website references intended to support his position that glyphosate should not be used on the MBS National Forest. All websites were reviewed (except those that could not be opened). In general, the web references duplicated information that has already been incorporated into the SERA 2011 Risk Assessment and DEIS; or contained unsubstantiated opinion pieces, or were not relevant to the project (e.g. about food crops, US pesticide policies). A change was made to the alternatives in response to this comment; POEA surfactants that increase toxicity of glyphosate will not be used. This means that only lower risk glyphosate formulations (SERA 2011) would be used in any all alternatives.

One comment letter suggested ways to make treatments more cost-effective, including a suggestion to increase the treatment caps and duration of the project, and making sure that personnel who can identify invasive plants are not restricted to Forest Service specialists. These comments did not result in changes to the alternatives. The specified project caps and duration allow for a consistent analysis across resource areas and are based on reasonable assumptions. The caps would not likely to inhibit treatment of invasive plants, given the expected funding. If the project caps or duration became impediments to effective treatment, additional analysis could be done to identify effects of a modification. The alternatives already allow qualified people outside the Forest Service to identify invasive plants. The 13,500 acre life of the project herbicide use cap has been clarified to include only acres that are not currently mapped.

Additional or Modified Analysis

A few of the comment letters indicated that additional analysis should be prepared to address topics that were not adequately addressed in the DEIS. Prevention of invasive plants by changing land uses, the adequacy of the wildlife analysis, and analysis about glyphosate were questioned.

Prevention is addressed by tiering to the R6 2005 FEIS and the MBS 2005 EA, including the prevention best management practices established by the MBS. The cumulative effects analysis (pages 78-86) discussed the relationship between land uses and the potential spread of invasive plants and how prevention influences the spread of invasive plants. The different vectors or ways that invasive plants are spread and how prevention is integrated into land uses was discussed in Chapter 3, the affected Environment and Environmental Consequences and is also covered in Chapter 2 (2.3.3 Management Requirements and Mitigation Measures , pages 32 to 42 of the DEIS).

The inadequacies described for the wildlife analysis were based on one summary statement, however Chapter 3.5 provides additional information. The summary statement has been edited for accuracy and clarity.

One commenter expressed that the analysis was inadequate because it did not include information about "opposing views" concerning risks of glyphosate use. Several website links and excerpts under the heading "opposing views" were attached to the comment letter.

Some of the articles are related to GMO agriculture and concerns about crops designed to resist glyphosate. Concerns about GMO agriculture are not relevant to effects of using glyphosate for invasive plant treatment.

Some of the articles are reiterations of studies that were reviewed and cited in the SERA 2011 Risk Assessment on glyphosate. These studies are cited in the narrative and sometimes integrated into the quantitative data about human health hazards or environmental fate of glyphosate in the risk assessment (and Chapter 3 of the DEIS).

Some of the articles express opinions about Monsanto as a company; international policies about pesticide use and registration; or how studies are funded. These issues are outside the scope of this project. The project is designed to comply with all laws, policies, standards and guidelines related to pesticide use. The analysis incorporates best available scientific information.

Corrections

The comments resulted in a few corrections to the DEIS.

Explanations

Table G- 2 below lists all comments to the DEIS and Forest Service responses. The responses generally fall into category 5 with explanations provided where warranted.

Table G- 2. DEIS comments and the Forest Service responses

ID	Comment Number	Comment	Forest Service Response
5	1	Good! Glad to hear that the USFS is going to be addressing the control of non-indigenous plant species with effective current technology.	This comment does not warrant changes to the project or analysis or further explanation.
6	1	When I recreate in our beautiful WA backwoods and draw water while camping, my expectation has always been that it will be the cleanest, unspoiled water commensurate with my surroundings. Now I have a concern that Ranger Rick, being concerned that the Speckled Vagina Fern is being decimated by Aggressive Dick Weed or some such, has been allowed to spray herbicide in our otherwise pristine backwoods, which may end up in my drawn water. Unless there is risk that all the evergreens will be wiped out by the Dick Weeds, my vote is to keep meddling mittens away from mother nature and let her take her course. We already have corporations infecting our environment with chemicals from every direction, can't we at least leave our pristine backwoods alone? I would be much more concerned for the wildlife out there (which on occasion is chemically-sensitive me and family) with well-intended chemical/herbicide sprayers than I would be about some aggressive plants left alone. Here's a test: If I'm out camping and see herbicide sprayers, I'll rinse some leaves off and pour it into a cup and ask them to drink it. If they're not cool with that, then it's a stupid idea since I'll be drawing water nearby myself. It's my strong opinion that us humans need to wise-up and stop reaching for chemical "solutions" to fix problems (imagined or otherwise). If it's that big of a problem, find another way that doesn't violate commonsense by spraying poison in the wilderness.	This comment does not warrant changes to the project or analysis. Drinking water quality would not be adversely affected by this project. Clean water is valued on the MBS. While we would not recommend drinking unfiltered water from streams on the MBS, the proposed use of herbicides would not make the water less safe to drink. The DEIS discussed worst case scenarios for drinking water and the amount of herbicide that could possibly reach water bodies on the MBS would be far below any level of concern for human health (DEIS page 98). DEIS page 169 discussed how levels of herbicide in *soil* adjacent to treatment are lower than amounts that would exceed drinking water thresholds if present in adjacent streams. DEIS page 187 cited Washington State Department of Agriculture monitoring (WSDA 2004, 2005 and 2006) for residual concentrations of herbicides for treatment of invasive plants in aquatic-emergent habitats. Ten out of the sixteen sites sampled between the years 2003 and 2005 showed residual herbicide levels that were below a level of concern for drinking water. The rest showed no detectable level of herbicide. DEIS page 189 noted that treatments along roads are unlikely to result in concentrations of herbicide reaching streams in amounts likely to harm drinking water. The cautious thresholds of concern and maximum herbicide exposure scenarios studied are intended to account for chemical sensitivity and posting and public notification are intended to help people avoid even implausible exposure. The impacts of invasive plants are often subtle, but can seriously degrade the environment. DEIS page 109-110 noted that the risk to native plant communities from competition from invasive plants is greater than the risk of treatment and that the more quickly invasive plants can be controlled, the better the chance for long term survival and viability of native plant communities. DEIS pages 117-118 detailed the adverse effects on wildlife from invasive plants. Page 137 noted that wildlife habitats would become degraded over time under the No-Action Alternative. Page 196 discussed the adverse impacts of invasive plants on riparian and fish habitats. Page 225 stated that invasive plants degrade wilderness values. Remote areas on the MBS (e.g. backwoods) are not pristine in the sense that human activities have resulted in the introduction of invasive

ID	Comment Number	Comment	Forest Service Response
			plants while also disturbing land and thus increasing susceptibility to invasive plant spread. Invasive plants have found their way even to wilderness areas. Removal of invasive plants would help restore the pristine quality of remote areas including wilderness. Forest Service management direction includes early detection and rapid response to invasive plants before their adverse impacts become obvious. Thus, the Forest Service does not have the option of leaving aggressive invasive plants alone. Invasive species management on public lands is required by Executive Order 13112. The 2013 Forest Service National Strategic Framework for Invasive Species Management noted that invasive species are among the most important environmental threats. Invasive species were identified by a recent Chief of the Forest Service as one of the four threats to forest health. Invasive plants are displacing native plants, potentially destabilizing streams, reducing the quality of fish and wildlife habitat; and degrading natural areas. Herbicides are an important part of integrated invasive plant treatments. Impacts of herbicide use would be mitigated to the greatest extent possible while still allowing for cost-effective treatments. The DEIS acknowledged the concerns people have about the potential impacts of herbicide use on water, wildlife, human health and other ecosystem components. DEIS Page 86 summarized the reasons why adverse impacts would be minimal.
7	1	We support the DEIS for the Mt. Baker-Snoqualmie National Forest Invasive Plant Management Project.	This comment does not warrant changes to the project or analysis or further explanation.
8	1	I strongly support the preferred alternative for managing invasive plants in the Mt. Baker-Snoqualmie NF. I have spent over 200 hours controlling invasive plants (mainly English ivy) on public lands using mechanical means. I also have used herbicide to control knotweed. I think that herbicide control is an environmentally-acceptable tool when applied at appropriate times, places, and appropriate target species. The drawbacks associated with further invasive plant spread far outweigh the drawbacks associated with herbicide use. I support USFS's preferred alternative.	This comment does not warrant changes to the project or analysis or further explanation.
9	1	Regarding your plans to use chemical control on Forest Service land. I hike year-round on the Olympic Trail Systems. I am a chemically sensitive person registered with the State of Washington. I came across a sign by the Little Quilcene Trailhead warning that it had been sprayed with glyphosphate [sic] on	This letter was forwarded to the Olympic National Forest. Invasive plant managers on that Forest responded with a letter to this commenter explaining the notification process. The comment does not warrant changes to the proposed project or analysis. The proposed MBS project includes mitigation measures 45-50 including detailed notification

ID	Comment Number	Comment	Forest Service Response
		10/1/14. My group and I arrived to hike that trail 10/2/14. Those of us who are negatively affected by chemicals choose outdoor activities specifically to avoid exposure to things that make us ill. We come to the forest with the expectation of a chemical-free experience. My friends and I had no way of being warned to stay off that trail. We were exposed just by being there to read the warning sign. Herb Robert and thistle were listed as the target of the glyphosphate [sic]. These two are non-toxic weeds, common to our state. However, the glyphosphate [sic] used to kill them is a harmful toxin. The MSDS for Round-up states that is hazardous to fish, and the Little Quilcene River runs alongside that trail that was sprayed. This is not how I expect the Forest Service to administer our tax dollars. Please respond to this query with information regarding use of chemical controls on weeds in recreation areas.	procedures for a variety of sites (DEIS pages 33-39). The cautious thresholds of concern and maximum herbicide exposure scenarios studied are intended to account for chemical sensitivity and posting and public notification are intended to help people avoid even implausible exposure. The fact that the commenter saw the sign on the Olympic National Forest indicates the notification system worked to alert this person to the potential for inadvertent exposure. DEIS page 229 disclosed the potential negative effect if forest visitors feel they must go elsewhere to avoid herbicides that have been applied to invasive plants in their favorite recreation spot.
10	1	I strongly support the Forest Service adopting the Proposed Action (Alternative 2). Invasive species pose one of the greatest risks to native ecosystem functioning, especially in the face of climate change. Neither Alternative 1 nor Alternative 3 will allow the Forest Service to adequately treat current and new invasive plants in a timely or cost-effective way, meaning that desired future conditions will be virtually impossible to achieve. The addition of aminopyralid to the list of approved herbicides is a good one. It is extremely effective against many of the most invasive plants, including hawkweeds and thistles. Yet it poses lower risk to non-target organisms than me herbicides currently in use. The use of broadcast spray is the only cost-effective way to treat large patches. The careful use of broadcast spray from a small truck-mounted sprayer is effective and safe. Integrating these additional tools into the integrated pest management approach will help increase the chance of success in controlling these non-native invasive plants that are often changing and degrading natural ecosystem functions, including wildlife habitat. Treating invasive species in wilderness areas should be one of the highest priorities for the program. If invasions are allowed to continue, the value and function of the wilderness areas will be considerably degraded. The use of EDRR and allowing staff to move quickly to develop site prescriptions and treating newly found patches as soon as possible is the only way that the Forest Service will ultimately	This comment does not warrant changes to the project or analysis or further explanation.

ID	Comment Number	Comment	Forest Service Response
		control species that spread quickly. It greatly increases cost to wait for a year or more to initiate treatment.	
11	1	My family grew up in Darrington. We hiked and fished at various locations in the Mount Baker-Snoqualmie National Forest. Your proposal to kill wildlife, fish and human visitors by applying poison to the foliage of invasive plants is clearly out of line. Your DEIS did not indicate the acceptable number of deaths per acre of noxious weed eradicated.	This comment does not warrant changes to the project or analysis. There is no proposal to kill wildlife, fish or human visitors. The risks associated with invasive plant treatment are discussed throughout the EIS, including potential impacts to non-target plants, habitat, and non-lethal impacts to fish and wildlife (DEIS Chapter 3). Plausible impacts are informed by herbicide risk assessments that represent the best available science regarding risks of herbicides proposed for use on the MBS (DEIS page 71). The effects analysis based on best available science does not indicate that ANY wildlife, fish or people will be killed from this project.
11	4	How did you convince a wildlife biologist to lead a project that will kill wildlife? How did you convince Ms. Reed to look the other way when confronted with science showing that herbicides containing glyphosate are potentially lethal to wildlife … especially birds?	This comment does not warrant changes to the project or analysis. No evidence indicates that birds or other wildlife species would be killed by the ongoing or proposed glyphosate use in this project. DEIS pages 134-135 noted that “disturbance from manual and mechanical treatment pose greater risks to terrestrial wildlife species [including birds] of local interest than herbicide use.” There is a very low likelihood that herbicide exposure under this project would adversely affect birds (DEIS page 137).
11	5	Incredibly, Mr. Everest chooses to ignore the fact that fish and other aquatic organisms are killed instantly when the concentration of glyphosate is as small as 1 part per billion.	This comment does not warrant changes to the project or analysis. Glyphosate “coming into contact with water would be well below a threshold of concern, or non-detectable (DEIS page 214).” Mitigation measures and herbicide use buffers restrict application methods and formulations in areas near streams and along roadside ditches. The threshold of concern (toxicity index) for glyphosate is based on non-lethal impact (DEIS page 209). Laboratory studies indicate the olfactory sense of salmon is affected at concentrations greater than 1 part per million (1 mg/L). On certain occasions when rainfalls occur during or soon after herbicide application, fish could be exposed to glyphosate concentrations leading to the occurrence of sub-lethal effects. Outright mortality of fish from herbicide exposure is highly unlikely. While it is possible that individuals would express impaired normal behavioral patterns these outcomes would be limited because exposures would be too intermittent, based on the expected action and its incorporated mitigation measures. As a result, these outcomes are not likely to produce an observable change in the abundance, distribution, diversity, or productivity of fish species at either the population or species level (DEIS pages 215-216).

ID	Comment Number	Comment	Forest Service Response
11	6	Analyze a 4th action alternative in detail that would prohibit glyphosate application anywhere on the forest for any reason. Indeed, this 4th alternative would meet the P&N. Why? The P&N says nothing about using a specific herbicide.	This comment does not warrant changes to the project or analysis. Under the No-Action Alternative, glyphosate would remain the herbicide used on the greatest number of acres and sites on the MBS (DEIS at table 5). The proposed action would use comparatively less glyphosate because new treatment options would be available; however glyphosate would remain the first choice herbicide for about 40 percent of known target plant acreage. No evidence suggests that there is a need to eliminate use of glyphosate to meet Forest Plan or other management direction. The Proposed Action would reduce the relative amount of glyphosate use by authorizing use of a wider variety of herbicide. The project design and mitigation measures associated with all alternatives would reduce the potential impact of glyphosate on the environment. DEIS Chapter 2.6 (page 52) discussed dropping glyphosate in the alternatives considered but not developed for detailed study.
11	7	Try to value life more than you value the need to participate in the USDA's criminal support of Monsanto. Federal officials who knowingly take action that will place public health and safety in jeopardy by "concealing" important information violate 18 U.S.C. § 1001 and are thus subject to up to 8 years in prison.	This comment does not warrant changes to the project or analysis. Public health and safety would not be placed in jeopardy and important (relevant, credible) information is disclosed. The DEIS discussed the potential health effects to workers and public from herbicide use proposed in the alternatives (DEIS Chapter 3.3. page 94-105.
11	2, 8	Page S-2 indicates you currently apply herbicides on the forest that contain glyphosate. Your proposed action indicates you will continue to spew this poison on the forest. Glyphosate is a toxic poison and must never be applied to public land where families recreate.	This comment does not warrant changes to the project or analysis. No Action and all action alternatives retain use of glyphosate. Glyphosate properties and potential risks to human health were discussed on DEIS pages 71-78 and 94-105 and in SERA 2011. This herbicide has been subject to scrutiny and analysis for decades. It is one of the herbicides included in Standard 16 (see DEIS table 2) based on the R6 2005 FEIS to which this document is tiered. The R6 2005 FEIS and ROD are available in the project record. Glyphosate has many characteristics that are beneficial; it is quickly absorbed into target plants. It also readily binds with organic material and becomes biologically inactive. It is effective on many target species, however it is non-selective. Use of glyphosate as proposed poses low risk to human health. Management requirements and mitigation measures minimize risks associated with chemical uses.
11	10	There is information widely available that discusses the dangers and toxicity of some herbicide products sold over-the-counter in America. Other countries protect their citizens by taking the vast amount of scientific information seriously. If these products (in this case herbicides) provide profit for the corporation that manufactures the product, the corporation will stop at nothing to	This comment does not warrant changes to the project or analysis. The pesticide use approval process differs in other countries from the process in the USA. The formulations approved for use and the product labels also may differ. The pesticide registration process is outside the scope of a Forest Service project. The analysis is based on best available scientific information, including a detailed risk assessment for

ID	Comment Number	Comment	Forest Service Response
		prove their product is safe. Incredibly, some government regulatory agencies (FDA, EPA etc.) choose to look the other way when confronted by these dangers. This is the case with Monsanto and their herbicides that contain glyphosate. There are scores of brand names for herbicides that contain glyphosate. Roundup is the most popular.	various formulations containing glyphosate (SERA 2011).
11	11	There is a reason the United States is currently having a cancer epidemic much worse than other industrialized countries. Even casual exposure to herbicides that contain glyphosate is shown in the lab to cause cancer in mammals. Of course now you are wondering what you can do to disprove these science conclusions. You might not even believe that glyphosate is unsafe. I suggest you search the WEB for the 2 words “glyphosate” and “cancer.” When you do you will get 79,600 hits. Most of the human and non-human animal deaths caused by glyphosate exposure will be cancer-related.	This comment does not warrant changes to the project or analysis. Glyphosate is not considered a carcinogen. The 2011 glyphosate risk assessment noted that some “equivocal” evidence of carcinogenic or mutagenic potential have raised concerns, at least in terms of risk perception (e.g., Cox 1998a, 2004; Watts 2010). However, given the marginal mutagenic activity of glyphosate, the failure of several chronic feeding studies to demonstrate a dose-response relationship for carcinogenicity, and the limitations in the available epidemiology studies on glyphosate, the risk assessment found that the “Group E classification in U.S. EPA/OPP (1993a, 2002) appears to be reasonable.” Group E classification means that there is no evidence of carcinogenicity for humans. Many web articles were supplied by the commenter to support the contention that there is a link between glyphosate use and occurrence of cancer. The web articles were reviewed and no relevant new scientific information was presented in the articles; the results of the review are in the project record and available electronically.
11	13	Hundreds of well respected Ph.D. scientists [have described] their research findings on the safety of herbicides containing glyphosate. Their research indicates glyphosate containing herbicides clearly kill fish at very small concentrations and are linked to the following health problems in mammals (including humans): • birth defects, • non-Hodgkin’s lymphoma (a form of cancer), • mitochondrial damage, • cell asphyxia, • miscarriages, • attention deficit disorder, • endocrine disruption, • DNA damage, • skin tumors, • thyroid damage,	This comment does not warrant changes to the project or analysis. The linked articles and reports submitted as part of this comment letter were reviewed by Forest Service pesticide use specialists (except where the links provided could not be opened). The Forest Service review of the list of linked articles is available in the project record. Studies linking glyphosate to cancer, neurological diseases, birth defects, and other health concerns generally are for herbicide use rates, formulations, or uses that are dissimilar to this project. Some of the websites refer to cellular level studies that are not applicable to real world exposure risks. Research conducted on whole organisms (e.g., rats, quail, etc.) using plausible exposure routes (e.g., dietary, direct spray) with glyphosate provide the best available science regarding risk from Forest Service applications. Whole organism studies have been conducted, have been reviewed by the EPA, are included in Forest Service risk assessments, and form the basis of our conclusions. The herbicide risk assessments used by the Forest Service are based on a compendium of scientific research and have been peer reviewed and are considered best available science. The risk assessment

ID	Comment Number	Comment	Forest Service Response
		• hairy cell leukemia (another cancer), • Parkinson disease, • premature births, • decrease in the sperm count, • harm to the immune system in fish • death of liver cells, • severe reproductive system disruptions • chromosomal damage. There are thousands of sites on the web that clearly indicate glyphosate is potentially lethal. Incredibly, you depend on a single document endorsed by the USDA declaring that glyphosate is safe.	incorporated the findings of credible studies in the open literature. Chapter 3.1.4 described herbicide toxicity analysis of proposed herbicides in the project (DEIS pages 71-78). Chapter 3.3 discussed potential health effects to workers and public from herbicide use proposed in the alternatives (DEIS page 94-105).The toxicity data on technical grade glyphosate are extensive, including both a standard set of toxicity studies submitted to the U.S. EPA/OPP in support of the registration of glyphosate as well as a robust open literature consisting of numerous and diverse in vivo and in vitro studies. As with any complex collection of studies, the studies on technical grade glyphosate may be subject to differing interpretations. The preponderance of the available data, however, clearly indicates that the mammalian toxicity of glyphosate is low, and very few specific hazards can be identified. Doses of technical grade glyphosate that exceed around 300 mg/kg bw may cause signs of toxicity, including decreased body weight gain, changes in certain biochemical parameters in blood as well as tissues, and inhibition of some enzymes (i.e., P450) involved in the metabolism of both endogenous and exogenous compounds. At doses from about 1000 to 5000 mg/kg body weight, glyphosate can cause death. There is no indication that technical grade glyphosate causes birth defects. For comparison, the largest potential dose (in mg/kg) a person might receive based on this project would be a child drinking water from a pond in which 200 gallons of glyphosate has been spilled. The estimate dose of glyphosate under this implausible scenario would be about 8 mg/kg body weight (SERA 2011).
11	14	Several countries have banned or are considering a ban on glyphosate. Thus, the Forest Service should not use this chemical for invasive plant control. Please respond. This is not a rhetorical question. Would you apply a chemical to your yard where children play in the grass that was banned in Denmark 10 years ago because of its lethal effects? Would you apply a chemical to your yard where children play in the grass that the Institute of Science in Society based in London England calls for banning in England? Would you apply a chemical to your yard where children play in the grass that Italy wants banned for use in the country? Would you apply a chemical to your yard where children play in the grass that El Salvador banned in October 2013? Would you apply a chemical to your yard where children play in the grass that Sri Lanka banned in March 2014?	This comment does not warrant changes to the project or analysis. The DEIS describes how herbicide use proposed on the MBS would follow applicable policies, plans, standards and guidelines. The Forest Service has assessed the use of glyphosate for decades. The R6 2005 ROD approved the use of this herbicide on National Forests in Oregon and Washington. Updated information in the 2011 SERA Glyphosate Risk Assessment was incorporated into the DEIS. The legality of herbicide use in other countries in not relevant to herbicide use proposed on the MBS. The several web articles that were linked to this comment were reviewed and no additional relevant scientific information was found that has not already been considered in the risk assessment and analysis results documented in the DEIS. Many of the articles are related to genetically modified agriculture and not relevant to this project. The literature review is electronically available in the project record.

ID	Comment Number	Comment	Forest Service Response
11	15	Ask yourself why Congress included Section 735 in the 2013 spending bill (HR 933) that was signed by President Obama. Section 735 is known by many as the "Monsanto Protection Act."	This comment does not warrant changes to the project or analysis. Section 735 expired with the 2013 spending bill. Section 735 related to genetically modified agriculture.
11	16	We know glyphosate-containing herbicides are potentially lethal… but there is more. Within the last few days new research results have been made public. Roundup is responsible for the massive monarch butterfly population reduction.	This comment does not warrant changes to the project or analysis. The research results cited are about how the loss of milkweed has contributed to butterfly decline. The relationship to glyphosate is that this herbicide is used to kill unwanted milkweed. No native plants important for butterfly habitat on the MBS would be treated in this project.
11	17	Glyphosate causes children to be born with birth defects: “Farm families that applied pesticides to their crops in Minnesota were studied to see if their elevated exposure to pesticides caused birth defects in their children. The study found that two kinds of pesticides -- fungicides and the herbicide Roundup -- were linked to statistically significant increases in birth defects. Roundup was linked to a 3-fold increase in neurodevelopmental (attention deficit) disorders.” [EHP Supplement 3, Vol. 110 (June 2002), pgs. 441-449.]	This comment does not warrant changes to the project or analysis. Studies about birth defects and attention deficit disorder were considered in the 2011 Glyphosate Risk Assessment. There is no indication that technical grade glyphosate causes birth defects (SERA 2011). A study found a tentative association between attention deficit disorder and use of glyphosate, however since the time of this publication in 2002, no additional studies further clarifying this association have been published (ibid.).
11	18	The establishment of the World Health Organization (WHO) Acceptable Daily Intake (ADI) is based on limited studies using limited parameters which do not account for vulnerable groups such as children, the elderly, the sick and other groups that might have increased susceptibility to glyphosate exposure.	This comment does not warrant changes to the project or analysis. The threshold of concern is based on sensitive subgroups such as women of child bearing age and children. Forest Service risk assessments incorporated an uncertainty factor of 10 to account for sensitive individuals (DEIS page 101).
11	19	Would the Journal of Environmental Research and Public Health have reason to publish a story that is not true? “Abstract: The current chronic kidney disease epidemic, the major health issue in the rice paddy farming areas in Sri Lanka has been the subject of many scientific and political debates over the last decade. Although there is no agreement among scientists about the etiology of the disease, a majority of them has concluded that this is a toxic nephropathy. None of the hypotheses put forward so far could explain coherently the totality of clinical, biochemical, histopathological findings, and the unique geographical distribution of the disease and its appearance in the mid-1990s. A strong association between the consumption of hard water and the occurrence of this special kidney disease has been observed, but the relationship has not been explained consistently. Here, we have hypothesized the association of using glyphosate, the most widely used herbicide in the disease endemic area and its unique	This comment does not warrant changes to the project or analysis. The linked article discusses kidney disease in Sri Lanka and other countries. The article appears to be similar to previous citations and relates to extensive agriculture uses of glyphosate and the amount and formulations used are not clear in the study. The Sri Lanka epidemic started before use of glyphosate and there is no evidence that similar problems are occurring from the type of glyphosate use proposed for this project.

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		metal chelating properties. The possible role played by glyphosate-metal complexes in this epidemic has not been given any serious consideration by investigators for the last two decades. Furthermore, it may explain similar kidney disease epidemics observed in Andra Pradesh (India) and Central America. Although glyphosate alone does not cause an epidemic of chronic kidney disease, it seems to have acquired the ability to destroy the renal tissues of thousands of farmers when it forms complexes with a localized geo environmental factor (hardness) and nephrotoxic metals.”	
11	20	Would the International Agency for Research on Cancer have reason to publish a story that is not true? These studies indicate that glyphosate doubles the risk of non-Hodgkin’s lymphoma.	This comment does not warrant changes to the project or analysis. The glyphosate risk assessment (SERA 2011) discussed studies related to glyphosate and non-Hodgkin’s lymphoma. Studies on the potential carcinogenicity of glyphosate in humans are based on self-reports of exposure to glyphosate by individuals with cancer [including non-Hodgkin’s lymphoma] (ibid). The association between glyphosate and non-Hodgkin’s lymphoma was not always statistically relevant and EPA has found that the epidemiologic evaluations cited do not establish a definitive link to cancer (ibid).
11	21	Would the USGS have reason to publish a false report in Environmental Toxicology and Chemistry? [The attached article discusses persistence of glyphosate in air and water in the Mississippi Delta Region].	This comment does not warrant changes to the project or analysis. The information in the attached article does not appear to be relevant to the MBS use of herbicides. The data is from Mississippi Delta region, a huge agricultural area, thus the type of herbicide use proposed on FS land is not similar. The DEIS acknowledged that herbicides, including glyphosate, may be transported by drift (air), leaching through the soil, or surface runoff (DEIS pages 185-186). The DEIS described the soil properties that influence chemical mobility in the environment (DEIS page 167). The proposed action includes management requirements and mitigation measure to reduce potential for herbicides to move off site (DEIS page 169, 188).

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11	23	In Californians for Alternatives to Toxics, et al. v. Michael Dombeck, Civ. S-00-2016 LKK/JFM (2001), Judge Lawrence Karleton presiding in the United States District Court for the Eastern District of California made the following findings: “The Forest Service cannot proceed with the plan until it assesses how use of the herbicides would affect the spread of noxious weeds and considers new information that calls into question earlier Forest Service findings that use of the herbicides would not harm humans and wildlife."	This comment does not warrant changes to the project or analysis. The R6 2005 FEIS explored various management alternatives that included different herbicide ingredients and different standards for their use, and considered how these standards might affect the spread of invasive plants. The MBS DEIS Chapter 3.1.5 discussed the relationship between land uses and the spread of invasive plants. Chapter 3.2 discussed the effectiveness of each alternative in treating invasive plants, given their expected continued spread. The Forest Service has assembled updated scientific information about the effects of herbicides, including risk assessments completed by SERA.
11	24	You must act according to NLRB rules. Private industry must notify workers when they will be required to work under conditions that are potentially fatal. Please make hardcopies of this section of these comments and Opposing Views Attachment #9a and give them to the people who will be applying the herbicides that contain glyphosate. Also, mail them to the worker’s family.	This comment does not warrant changes to the project or analysis. The Forest Service follows appropriate worker safety laws and regulations. Forest Service Pesticide Use Manual 2150 states that: In managing and coordinating the use of pesticides, it is Forest Service policy to: 1. Conduct all pesticide-use activities using an integrated pest management approach to improve overall treatment effectiveness and to reduce pesticide risk(s) for both humans and the environment. 2. Conduct all Forest Service pesticide-use activities in full compliance with applicable Federal laws, regulations, and other authorities including, but not limited to, the Federal Insecticide, Fungicide, and Rodenticide Act, the National Environmental Policy Act, and the Endangered Species Act. Relevant State and local laws pertaining to the use of pesticides will be followed when not in conflict with Forest Service management authorities and objectives. 3. Require that all pesticide-use activities conducted by non-Forest Service personnel on the National Forest System, or other areas administered by the Forest Service, be in compliance with applicable EPA pesticide label restrictions and other applicable Federal and State laws and regulations including the Federal and State laws and regulations that apply to personnel training and licensing. 4. Require that all Forest Service personnel who use any biopesticide or general-use chemical pesticide (other than household pesticides) on terrestrial or aquatic areas of the National Forest System be trained in the proper, safe, and effective use of the respective pesticides being applied for the management activity. Pesticide-use training and certification for Forest Service employees who use, or directly supervise the use of, restricted-use pesticides will be accomplished through an appropriate EPA-approved State program or a national Forest Service certification program.

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			5. Incorporate pertinent pesticide-use policy and related handbook guidance into all management activities on the National Forest System and other lands, waters, or facilities administered by the Forest Service; including but not limited to procurement activities, contracts, permits, leases, and agreements to foster the safe and effective use of pesticides. As discussed in the DEIS table 2, all herbicide applicators would be licensed or directly supervised by a licensed applicator. The Forest Service conducts job hazard analysis and communicates risks of various kinds of projects to works.
11	25	Syracuse Environmental Research Associates updated of their 2006 report addressing glyphosate safety in 2011. It is titled "Glyphosate Human Health and Ecological Risk Assessment" was completed on March 25, 2011 under USDA Forest Service Contract: AG-3187-C-06-0010 and submitted to Paul Mistretta, COR USDA/Forest Service, Southern Region. The report points out not all glyphosate formulations are the same. Table 2: Glyphosate Formulations Identified by the Forest Service (pages 281 and 282) identifies 53 different herbicide formulations containing glyphosate. Table 5: Classification of formulations (page 287) shows the toxicity of the different formulations presented by toxicity levels and confidence. Unfortunately, Supervisor Eberlien you indicate glyphosate will be applied without describing the specific formulation that will be applied. According to SERA there are 11 formulations of glyphosate-containing herbicides that are "low toxicity." Please apply one of the 11 glyphosate formulations that (according to SERA) are low toxicity and indicate the specific formulation that will be applied.	Higher risk formulations of glyphosate were dropped from the alternatives in response to this comment. The higher risk rating is based on the presence of POEA surfactants; these would not be approved for use in the alternatives.
11	26	Congress intended for federal agencies to make their responses to responsible opposing views available to the public to read. Simply placing a hardcopy of the Responsible Official's opposing views responses in the project file located at the district hides the information from the American public. How will the judge react when he/she finds out you expected the public to fly thousands of miles to examine a document that legally must be available to the public? Include an electronic response to each responsible opposing view contained in the Opposing Views Attachments and post these responses online for the public to examine. The only legal way to avoid responding is to explain why the opposing view is irresponsible. Professionals do not selectively choose literature	This comment does not warrant changes to the project or analysis. The web links supplied in the comment letter often contain duplicative, misleading, irrelevant or sensationalized information. The R6 2005 FEIS (project record); SERA 2011 Glyphosate Risk Assessment (project record) and the MBS DEIS listed literature cited in the analysis. There is no requirement to provide reference material via clickable links. The comment letter, the attached articles themselves and the Forest Service review of the articles are in the project record and available on request, including electronically.

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		citations that support their case and systematically exclude those that don't. Supervisor Eberlien, there are hundreds of references listed in the 24-page Literature Cited section. There are 99 sources for the opposing views of Ph.D. scientists quoted in Opposing Views Attachments #9a. Even random selection of science literature related to herbicide safety would have included several of the documents cited in the Opposing Views Attachment #9a. None of this literature is listed in the Literature Cited section. Include some source documents from the Opposing Views Attachment #9a in the Literature Cited section. Also, cite the specific quotes included in the source literature chosen by this member of the public in the text of the EIS. Finally, include clickable links to the source documents you choose to include in your reference section.	
11	27	Supervisor Eberlien, you have consciously selected literature for the Literature Cited section that excludes science describing how logging will adversely affect non-timber natural resources in the sale area.	The project is not about logging, thus this comment is not specific to the proposed action and no response is warranted.
11	28	Reasonable people would have doubts about the wisdom of their proposed action that best science predicts will likely create major adverse impacts to the forested ecosystem.	Best science predicts that if invasive plants are not effectively treated, they will create major impacts to the forested ecosystem. In contrast, the project proposed by the Forest Service to effective treat invasive plants involve minimal risks, as discussed throughout DEIS Chapter 3.
11	29	You know the effects disclosures [in the DEIS] are inconsistent with the research conclusions of several hundred Ph.D. scientists [see excerpts in Attachment #9a].	This comment does not warrant changes to the project or analysis. The effects discussed in the DEIS are consistent with best available science. Many of the attached web citations are opinion pieces or news reports and do not contain scientific information.
11	3, 9, 22	Invasive plants are a major problem in our public lands. Treat these plants with a more costly, safer alternative – mechanical and biological means. I understand that natural vegetation and the resources that depend on the health of the natural vegetation will be significantly harmed if the non-native invasive plants are not eradicated. I also know there are effective (although more costly) alternatives to killing these plants other than herbicides. If most Americans knew of the tragic results stemming from contact with some herbicides they would insist that the USFS spend the extra money on these safer alternatives. Any reasonable, thinking, ethical person with this knowledge would deal with noxious weeds with the slightly more expensive alternatives to chemicals.	This comment does not warrant changes to the project or analysis. All action alternatives would approve mechanical and biological treatment (see DEIS 13-23). Biological treatments are relatively inexpensive, and biological agents help suppress or contain larger populations of some invasive plants. Mechanical treatments are also appropriate to contain some invasive plant populations; however mechanical treatment alone would not be effective on many target species. Absinth wormwood, comfrey, bindweed, and knotweeds are examples of invasive plants that cannot be effectively treated without herbicides (DEIS table 6). Cost-effectiveness is also an important factor in determining an appropriate course of treatment given funding limitations. The influence of treatment effectiveness compounds over time and more herbicide or other plant treatments may need to be used at a later date if the most effective treatment methods are not used earlier.

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11	12, 22	Supervisor Eberlien, please don't tell the public everything will be fine since you plan to apply the herbicide according to label directions. Monsanto would not dare to say anything that might indicate to the public there are health issues associated with their products. The label directions must not be trusted. Monsanto pays other chemical labs to do the safety research on their glyphosate-containing herbicides. These labs know what Monsanto wants. The label directions printed and composed by Monsanto are based on this type of so-called safety evaluation. It should not be necessary to explain further. Monsanto composes and prints the label directions! If you believe the outdated, biased USFS sources that show herbicides containing glyphosate are safe you will live the rest of your life wondering. The USFS has no mandate to prop-up Monsanto does it? Corporations like Monsanto, whose GMO-agriculture inventions (Bt corn; Roundup herbicide) now threaten human and environmental health alike, have moved beyond the stage of simply denying or minimizing the science revealing the harm being done by their products (there is too much science now to maintain this strategy!); rather, they are now investing in the burgeoning, multi-billion dollar industry practice known as "check book" science: find willing researchers, research institutions, and journals to create and publish information favorable to the company writing the check, and you're in business.	This comment does not warrant changes to the project or analysis. The mitigation measures and herbicide use buffers go beyond the label to reduce the potential for impacts. The analysis was informed by herbicide risk assessments prepared by an independent analyst (DEIS page 72, Table 20). The risk assessments were informed by peer-reviewed articles from the open scientific literature and current EPA documents and were discussed at length in the DEIs (pages 71-78). The herbicide registration and labeling process is outside the scope of the project EIS. The Forest Service use of glyphosate or any other herbicide is very small compared to the use of these chemicals in general (the R6 2005 FEIS estimated that Forest Service use comprises about 3 percent of the total use of herbicides in Oregon and Washington). The decision made on this project would not affect Monsanto.
14	1	As an organization committed to protecting Washington's native plants and their habitats, we are writing in support of Forest Invasive Plant Treatment DEIS Alternative 2, the preferred alternative analyzed in the Mount Baker-Snoqualmie National Forest (MBS) Draft Environmental Impact Statement. As Forest Service analysis indicates that this alternative provides the best protection for native plants within the forest, we believe it is the appropriate choice to ensure that the Forest Service has the ability to carry out its mission to "sustain the health, diversity, and productivity of the nation's forests and grasslands to meet the needs of present and future generations." We are assuming that the principles of Integrated Pest Management will be followed as part of this proposal. Sustaining the health and diversity of the forest requires controlling invasive plants and current methods used within the Snoqualmie-Mount Baker National Forest are not equal to the task, as evidenced by the increasing numbers of sites and acreage affected.	This comment does not warrant changes to the project or analysis. The project follows integrated weed management (IWM) principles. Integrated treatment prescriptions according to MR/MM would be developed based on a comprehensive list of site considerations (see DEIS pages 41-43).

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14	2	Washington Native Plant Society members monitor native plants and their habitats within the MBS. Our members participate in Weed Watcher programs and have observed increases of invasive species within the forest. We support adequately funding agencies that protect the health of the forest and are concerned about whether the Forest Service has the resources to ensure that validation of sites by invasive plant specialists, as specified in the DEIS, will be possible. We encourage the Forest Service to handle this concern in a way that ensures validation will be carried out in an expeditious manner as this will be critical to the overall success of the management plan. Studying plants in their native habitats, known as botanizing, is an activity that has a long history. Rooted in the oral traditions of our state's First Peoples (predating the historical record), documented in the journal of botanist and explorer David Douglas, and continuing today on the web with the meticulous records of the Burke Herbarium and the citizen-science compiled WNPS plant lists, botanizing is a discipline worthy of recognition and protection on our federal lands. The observations of botanizers have contributed to the human knowledge base and across cultures for thousands of years. Ensuring the health of native plant habitats of our public forest lands is critical to the need of our members to carry on this worthy pursuit. It is the mission of the Washington Native Plant Society to appreciate and protect the native plants of Washington. We advocate for the removal of introduced species that threaten native plants. We understand that invasive species management on public lands is required by Executive Order 13112 and appreciate the Forest Service actively responding to this problem. We appreciate the chance to work together on this important issue.	This comment does not warrant changes to the project or analysis The requirement for "validation by an invasive plant specialist" is intended to ensure that invasive plants are properly identified before they are treated. Any credible source could provide this validation. Under any alternative, the MBS supports expansion of the weed watcher program, and is committed to proper surveys to ensure early detection following ground disturbing activities. Surveys are accomplished through a variety of mechanisms and funding sources.
15	1	As organizations committed to stewardship of the natural resources of the Mt. Baker Snoqualmie National Forest (MBS), we are writing to express our support for Forest Invasive Plant Treatment DEIS Alternative 2, the preferred alternative. Measures proposed by Alternative 2 would greatly improve the capacity of the MBS to control invasive plants. Although invasive plants pose a grave threat to habitat throughout the Forest, the existing control program is handicapped by inadequate funding and outdated tools. Therefore, we support	This comment does not warrant changes to the project or analysis or further explanation. The Record of Decision will explain the Forest Supervisor's rationale for the decision.

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		implementation of Alternative 2, including the following measures: Allow use of all Region-6 approved herbicides, and aminopyralid In a perfect world, mechanical and manual control would be sufficient to limit the spread of invasive plants. However, such methods are often inadequate even for small infestations, let alone for large infestations widely dispersed across a National Forest. Especially on this landscape scale, herbicides are the only effective tool to control yellow archangel, yellow hawkweed, Bohemian knotweed, spotted knapweed, and many other species – aggressive invaders that if left alone, would eventually choke out habitat throughout the MBS. With the broader list of approved herbicides, the MBS control program will have access to the most effective, least-risk herbicide for each targeted species. Currently, for many species that "ideal" herbicide isn't an option. As a result, greater volumes of less effective herbicides are applied. Allow broadcast herbicide application For some species, spot spraying of dense infestations is ineffective. For example, spot spraying dense yellow hawkweed infestations will leave uncontrolled the seedlings and stolons growing between treated plants. As a result, treatments often must be repeated. For such infestations; broadcast application is superior both for control and for lessening the overall use of herbicide. Outside of Wilderness areas, allow mechanical control For some invasive plants, mowing and string trimming machines can be important nonchemical components of an integrated treatment program. For example, these methods can be effective for dense roadside stands of Himalayan blackberry, reed canary grass, and Scotch broom. Inside of Wilderness areas, allow all control methods except mechanical, broadcast Because remote infestations can be exceedingly difficult to access, we're fortunate that our Wilderness areas are relatively free of invasive plants. With access so difficult and time consuming, control must be effective the first time; this means using herbicides when needed. English holly and other invasive plants are showing up in remote trail-less areas and it will be a struggle to control them in the first place, let alone to return for follow-up control; therefore herbicides must be part of the control	

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		toolkit. Establish an Early Detection and Rapid Response (EDRR) process Timely control of new infestations is essential for effective weed control. Replacing the current cumbersome review process with a streamlined Early Detection and Rapid Response process is a critical step for the MBS control program. Currently, it can take one or more years from the time an infestation is reported to the time it is approved for control. Many invasive weeds spread rapidly, and this bureaucratic process can turn simple, inexpensive control projects into costly multi-year efforts. For example, about 15 years ago a butterfly bush infestation took root on the Middle Fork Road and spread to multiple sites along the Middle Fork Snoqualmie River (a single butterfly bush can produce hundreds of thousands of lightweight seeds that are easily dispersed by wind and water). These infestations could only be accessed by kayak or raft, or by fording the river in late summer. It took annual visits spread over 10 years to eliminate all infestations. Early control would have saved a great deal of work. When trained personnel locate an infestation that requires herbicide, and are equipped with the appropriate equipment and herbicide, they should have the authority to make a decision to control the infestation while still on site. Immediate control will prevent further spread of the plant and greatly increase the speed and effectiveness of control work overall. Washington State and county land managers already have EDRR programs with such policies in place. Until such a program is active on the MBS, its overall control program will be hobbled.	
15	2	Alternative 2 - Concerns and suggestions Maximum 5,000 acres treated per year and 13,500 for life of project The DEIS analysis is based on the existing data, as it should be. Measures proposed in Alternative 2 are an excellent response to what is known about weeds on the MBS. However, we believe those data paint an incomplete picture of the current state of weed infestations across the MBS, simply because most of the MBS has not been surveyed due to years of inadequate funding. We believe that the 10-fold increase from 2005 to 2014 in number of reported infestations is largely due to the vigorous citizen science survey programs created in that	This comment resulted in a minor clarification about the project caps. The project caps help us characterize the extent and significance of environmental impacts. The 5,000 acre per year project cap is based on the assumption that all currently infested sites are treated in a single year. This is an ambitious level that would require far more funding than we historically receive. It allows for analytical site-specificity and consistency. The 13,500 acre cap applies to new infestations detected over the life of the project. The annual and life of the project caps appear to be great enough to accommodate expected needs within the capacity of the Forest Service. Supplemental analysis could address changed conditions over time,

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		period, as well as expanded surveys by non-profit partners (work supported by the MBS, WA DNR, King County, and other agencies). In other words, the infestations already existed, but no one had been looking! While these surveys have been invaluable, they only covered a small percentage of trails, trailheads and other disturbed sites on the MBS, and even less of our river corridors and vast trail-less areas (or forests between trails). For example, two off-trail surveys this summer in the Middle Fork Snoqualmie Valley found more English holly sites than listed in DEIS table 5 for the entire MBS. We understand that the DEIS proposals must be based on existing data. However, given the limits of these data, and the strong likelihood that known infestations are the tip of the iceberg, we suggest that you allow adjustments to these acreage limits if new surveys uncover significantly more infestations	including consideration of an adjustment to project caps if need be.
15	2a	<u>Duration of project</u> Again, we understand that a DEIS analysis must be based on reasonable parameters, including number of years until completion. However, weed control will always be an ongoing process, especially for a National Forest adjacent to a huge metropolitan area and crossed by major highways. Whether invasive weeds are spread by vehicles, wind, or birds, they will continue to pose a major challenge. If the time limit can't be removed, there should be a mechanism to extend the period as needed. <u>Budget projections</u> The proposed budget indicates a commitment to a much-expanded control program. However, the estimated treatment costs don't seem to factor in the cost of controlling remote infestations. While "$200 per acre to accommodate the full range of treatment options at any given site" may be sufficient for roadside infestations, many newly reported infestations are in remote areas of the forest. To survey, control, and monitor sites that are far from roads and even from trails - the far end of decommissioned roads, campsites deep in the Alpine Lakes Wilderness, riverbanks reached by kayak or fording – will require significant staff time. Budgets must factor in full-day or multi-day trips to visit such sites. Related to this issue is the statement on DEIS page 61, under 3.1.1 "Treatment Analysis Areas": "This inventory is based on a variety of sources and not all sites	<u>Duration of Project</u> The 10 to 15 year life of the project estimate is also based on the current inventory, along with assumptions about budget and treatment. It is not intended to be a cap. This project may be implemented as long as similar conditions and treatment needs exist. <u>Budget Projections</u> The costs of inventory, planning and monitoring were not factored into the analysis. The analysis focused on differences in effectiveness between the alternatives. The cost estimates provided in the DEIS were not intended to reflect the full cost of managing invasive plants on the MBS. This EIS is not intended to precisely evaluate the cost of accessing remote sites. The cost of prevention is outside the scope of the alternatives and is not addressed in the EIS. The costs of treatment vary widely. Access is one consideration. In general, the cost of treatment would be greatest in places where eradication is desired. The requirement for "validation by an invasive plant specialist" is intended to ensure that invasive plants are properly identified before they are treated. Any credible source could provide this validation. Under any alternative, the MBS supports expansion of the weed watcher program, and is committed to proper surveys to ensure early detection following ground disturbing activities. Surveys are accomplished through a variety of mechanisms and funding sources.

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		have been validated by an invasive plant specialist. Validation by an invasive plant specialist would occur before treatment of any site." This seems to imply that only MBS invasive plant specialists may validate sites. Due to the limited number of MBS staff who can do this work, such a requirement would create a significant bottleneck for the EDRR program. We urge you to allow partners working under agreements with the MBS to validate sites as well. We urge you to expand support for the citizen "Weed Watcher" programs that have been active in the Upper Snoqualmie Valley for the last ten years. They've proven to be very effective, and provide a low-cost, enthusiastic survey team for the MBS, WA DNR, and King County weed control programs. To limit future infestations, we believe budgets for all ground-disturbing projects should support post-project surveys. MBS weed control protocols for construction equipment and materials are good, but it's inevitable that some weeds will be introduced. Without follow up surveys, weeds introduced by these projects can go undetected and uncontrolled for years.	
15	3	<u>No-Action Alternative – comments</u> A No Action decision, or a decision that eliminates key measures proposed in Alternative 2, would cause serious harm to the environment. Restricting control to the current set of approved herbicides would mean continued use of a higher volume of less-effective herbicides. Forbidding broadcast spray will have a similar effect, making it necessary to repeat spot spray application over multiple seasons. If an EDRR program isn't approved (or only a limited program is approved), easily controlled infestations will continue to grow into large, difficult-to-control infestations. When infestations aren't controlled on MBS lands, they quickly spread to neighboring city, county, and state public lands where all of these methods are generally allowed. So in the end, they will be used anyway, but likely in greater quantities than would have been necessary had the infestations been controlled at their source.	The ineffectiveness and potential adverse effects of the No-Action Alternative are acknowledged throughout the DEIS. The effectiveness of the prevention, treatment and restoration program on the MBS has the potential to influence treatments off the National Forest. Over time, more herbicide use may be required by other land owners and managers if invasive plants are not controlled on the MBS. Discussion about how No Action may affect invasive plants on lands adjacent to the MBS has been added to the FEIS.
16	1	We applaud the Department of Agriculture and National Forest Service's recognition of the extent to which pesticides in forests impact our economic and public health. This letter serves to provide additional information on the treatment plan and encourage the use of alternatives to harmful pesticides. We agree that treatments for invasive plants should be conducted in a manner that minimizes or eliminates human health and	This comment does not warrant changes to the project or analysis. This project follows Forest Service policies and the MBS Forest Plan. The general concern about overuse of herbicides was addressed in the R6 2005 FEIS (project record), resulting in Forest Plan goals, objectives, standards and guidelines that direct invasive plant management on the MBS. Table 2 in the DEIS listed invasive plant treatment and restoration

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		environmental risks. Although pesticides are scientifically linked to a wide range of human health and environmental issues, they are too often the tool of choice.	standards that apply to this project. Herbicide toxicity is a key issue addressed in the DEIS (DEIS page 11).
16	2	The three alternatives studied do not adequately address concerns with pesticide use in our national forests. A fourth alternative to the Invasive Treatment Plan should focus on manual or least toxic chemical weed control, include prevention techniques specific to forests, and study the failures of the current plan to explain the large increase in invasive species.	This comment does not warrant changes to the project or analysis. An integrated invasive plant management program is considered the most effective way to meet invasive plant objectives and follow policies, standards and guidelines. The more cost-effective the treatments considered, the more likely that the purpose and need for action will be met. The treatments and planning processes that are currently authorized in the 2005 MBS DN lack sufficient tools and efficiency to achieve timely eradication, containment and control of invasive plants. Alternatives that reduce the tools or cost-effectiveness of treatment would not help us achieve the purpose and need for action. All alternatives allow for manual treatment and “focus on the least toxic chemical weed control.” Cost-effective manual treatments would continue, often in combination with mechanical, cultural and herbicide methods, but sometimes as a stand-alone treatment. In 2005, the Regional Forester determined that ten herbicides were appropriate for use treating invasive plants throughout R6 (R6 2005 ROD page 9). Used in accordance with the R6 2005 ROD standards, these herbicide ingredients pose relatively low risks to people and non-target organisms (R6 2005 ROD page 8). Alternatives that would have further limited herbicide options (and increased emphasis on invasive plant prevention) was considered but not selected. The R6 2005 ROD discusses the Regional Forester’s reasons selecting the various invasive plant management standards. To increase cost-effectiveness while minimizing risk of adverse effects, the Proposed Action would also use aminopyralid. Aminopyralid compares favorably to the herbicides approved in the R6 2005 ROD. Forest-wide invasive plant prevention measures (BMPs) have been developed and would be followed regardless of alternative selected. These measures are specific to land uses on the MBS. New invasive plant detections are inevitable over time, despite our best efforts at implementing prevention measures. DEIS page 93 noted that species and site-specific models do not exist to more precisely predict the rate of spread and the influence of prevention measures. DEIS page 113 indicated that invasive plants would continue to spread at a rate of 4-12 percent over the life of the project. DEIS table 23 discussed ongoing land uses and activities that have the potential for spreading

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			invasive plants. Effective integrated invasive plant management involves prevention, early detection and rapid response, and effective treatment and restoration.
16	3	Support continued strict controls on the use of herbicides on forestlands.	Herbicide use would adhere to all policies and plans, including specific standards, guidelines, management requirements and mitigation measures as described in the DEIS (pages 32-40).
16	4	Use herbicides only as a last resort when other options are not feasible. Furthermore, they should only be used within an integrated program that emphasizes prevention, early detection and control.	Herbicide use would adhere to all policies and plans, in accordance with strict management requirements and mitigation measures. Herbicide use would be done in the context of an integrated program that emphasizes prevention, early detection and control. Non-chemical methods would continue to be used. (see management requirements #4 –"lowest effective herbicide use rates would be used for each treatment situation" – DEIS page 33). The Proposed Action would include a combination of effective and practical integrated treatments depending on the target species, location and other site conditions (DEIS page 26). The concept of using chemicals only as a last resort was discussed at length in the R6 2005 FEIS and the Regional Forester chose not to require that herbicides be used as a tool of last resort for invasive plant treatment in R6 (R6 2005 ROD page 27). Timely use of herbicide as needed would serve to reduce the total amount needed; waiting to prove that non-chemical methods are infeasible could result in greater use of herbicides in the long run. The R6 2005 ROD includes the objective to reduce reliance on herbicide use over time. DEIS page 42 noted that if the target species population is not associated with a size, phenology, density or distribution that warrants herbicide use (alone or in combination with other methods), or if herbicide use does not substantially increase treatment efficiency, then non-herbicide methods would be favored. The invasive plant treatment program on MBS includes prevention, early detection, integrated control methods, restoration and monitoring.
16	5	Use herbicides in a very limited and targeted way when non-herbicidal options are not feasible; do not use any broadcast applications but instead spot applications. Furthermore, sensitive sites including endangered species habitat and waterways should be avoided.	This comment does not warrant changes to the project or analysis. Herbicides would continue to be used in a limited and targeted way. An alternative was considered that eliminated broadcasting (DEIS page 53). Preliminary analysis for this alternative was conducted and the IDT found that the herbicide use buffers and Management Requirements and Mitigation Measures effectively minimized the risks of broadcasting. This alternative would have reduced treatment effectiveness without providing any additional resource protection so it was not developed for

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			detailed study. Protection of streams, water quality and riparian habitats is addressed through the herbicide use buffers. Effective treatment is very important within these areas and the current program has not kept up with treatment needs. The project would be beneficial to wildlife. Negative impacts to fish and wildlife, including species of local interest, are more likely with invasive plants than with the treatments proposed (see DEIS Chapter 3.5 and 3.8).
16	6	Make avoidance of activities that spread weeds a high priority. Activities that increase soil disturbance and decrease cover of native vegetation are the biggest problems, including: roads, logging, grazing, OHV use, fire suppression, altered fire regimes, and mining.	This comment does not warrant changes to the project or analysis. R6 2005 ROD (MBS Forest Plan) included the objective to reduce soil disturbance while achieving project objectives through timber harvest, fuel treatments, and other activities that potentially produce large amounts of bare ground. Another objective was to retain native vegetation consistent with site capability and integrated resource management objectives to suppress invasive plants and prevent their establishment and growth. The RF selected specific prevention standards to reduce the rates of spread of invasive plants, while still maintaining the Forest Service's ability to provide for existing uses and management activities on National Forest System land (see R6 2005 ROD page 9). In addition, Forest Service Manual 2070 notes that the Forest Service intends to maintain, restore or rehabilitate native ecosystems so that they are resistant to invasion by non-native invasive species.
16	7	Fully disclose weed spreading consequences of land management activities such as logging, roads, fuel treatments, grazing, OHVs, mining, fire suppression, and altered fire regimes. Furthermore, explore limiting these activities as a way to avoid the spread of weeds.	This comment does not warrant changes to the project or analysis. The R6 2005 FEIS (in the project record) specifically discussed vectors of invasive plant spread, including the land management activities mentioned in the comment. The R6 2005 ROD (in the project record) amended the MBS Forest Plan by adding management direction including prevention standards and guidelines. All land use activities on the MBS must incorporate invasive plant prevention measures. Site-specific land use decisions are the appropriate place document "weed spreading consequences" and prevention measures related to MBS projects. The RF considered, but chose not to adopt a *standard* to retain native vegetation and minimize creating soil conditions that promote the establishment and spread of invasive plants (see R5 2005 ROD page 15). However, the objective to: "retain native vegetation consistent with site capability and integrated resource management objectives to suppress invasive plants and prevent their establishment and growth" were included in the ROD. Chapter 3.1.6.3 in the DEIS disclosed that ground disturbance associated with natural processes and human activities may favor the

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			spread of invasive plants and discourage the reestablishment of native species. It noted that past and ongoing projects and activities on the MBS National Forest have the potential for inducing invasive plant spread where soils are disturbed. Table 22 discussed the site types where invasive plants are currently found and the risk of spread in these areas. Table 23 discussed types of land uses and activities that have the potential for spreading invasive plants.
16	8	Consider alternatives to herbicides at all stages of decision---making: program, plan, and project.	This comment does not warrant changes to the project or analysis. Non-herbicide methods have been fully considered at the program and planning scale, and will be considered during the implementation planning process. DEIS page 42 noted that if the target species population is not associated with a size, phenology, density or distribution that warrants herbicide use (alone or in combination with other methods), or if herbicide use does not substantially increase treatment efficiency (considering the availability of volunteers if needed), then non-herbicide methods would be favored.
16	9	Evaluate the risks of all herbicide ingredients, including all “inert” ingredients. Furthermore, these ingredients should be disclosed to the public.	This comment does not warrant changes to the project or analysis. This issue was discussed at length in the R6 2005 FEIS. The Forest Service does not have the ability to disclose all ingredients of herbicide formulations to the public however all ingredients are evaluated in risk assessments to the extent possible. The R6 2005 ROD requires that additives be addressed in Forest Service Risk Assessments. Information about additives and inert ingredients was provided in the DEIS.
16	10	We urge the Forest Service to do even more to prevent the spread of noxious and invasive species, including a review of the current monitoring plan for prevention. The Forest Service should take steps to determine the underlying causes for the 400% increase in invasive sites. The proposed change to map the sites and treatment are an important step forward and we support this development. While the DEIS strives to limit the adverse effects of noxious and invasive weeds, the current General Requirements fail to fully address the root causes that spread noxious and invasive weeds. These root causes include land management practices that disturb soil and native vegetation and a use of some products, such as straw hay—which, even if certified weed---free, may be exacerbating the problem of invasive plants.	This comment does not warrant changes to the project or analysis. The “underlying causes” of weed spread are discussed and addressed in R6 2005 ROD, and the spread of weeds are considered in the cumulative effects discussions in the DEIS (Chapter 3). The MBS implements Forest-specific best management practices to limit the spread of invasive plants (MBS 2005 EA). The R6 2005 ROD requires that prevention measures be addressed in all land use assessments. The R6 2005 FEIS acknowledged that invasive plants would continue to spread even though prevention measures are implemented. Existing treatment options have not consistently resulted in effective treatments. As described on pages 2 and 3 of the DEIS, the treatments currently approved has not been consistently effective and the Forest Service has not been able to respond rapidly enough to dynamic invasive plant populations. The use of certified weed-free straw and wood products for mulch are not likely to exacerbate invasive plant problems.

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16	11	The Forest Service should reconsider the use of straw hay in light of studies by Washington Department of Ecology, which found straw hay encourages the propagation of weed species (Washington Dept. of Ecology). The Washington Dept. of Ecology (Ecology) Stormwater Management Manual for Western Washington, 2005 edition, (SWMMWW) Volume II, Table 4.7 states: “Straw, however, has several deficiencies that should be considered when selecting mulch materials. It often introduces and/or encourages the propagation of weed species and it has no significant long---term benefits. Straw should be used only if mulches with long---term benefits are unavailable locally. It should also not be used within the ordinary high---water elevation of surface waters (due to flotation).” The Ecology SWMMWW BMP 230 also states that: “Straw bales are among the most used and least effective BMPs.” And “Under no circumstances should straw bale barriers be constructed in streams, channels, or ditches.” In lieu of using straw hay products that are likely to contain noxious weeds, more effective erosion controls such as wood straw, wood bark mulch, chipped native vegetation, or compost socks/berms where the compost has been commercially prepared and uniformly heated to a temperature capable of killing all seed germination should be used. These erosion control materials are intrinsically weed free.	This comment does not warrant changes to the project or analysis. General requirements associated with the use of straw as an erosion control or mulch is outside the scope of this project. The R6 2005 ROD (MBS Forest Plan) requires all straw hay and mulch used on the National Forest in R6 must be certified as weed free. The certification process involves field inspection to determine whether any invasive plants are present before the hay is baled. The intent is to minimize the risk of transporting seed or reproductive parts of invasive plants. The R6 2005 FEIS (page 3-22) noted that use of non-native straw has been observed to introduce invasive plants to the Biscuit Fire area in Southern Oregon. Field certification for weed free status is considered highly effective in reducing the potential for invasive plants to become introduced through straw bales (R6 2005 FEIS page 4-10). However, it does not reduce risk to zero. In the action alternatives, MR/MM 28 (page 36) requires areas of gouging or soil displacement resulting from manual treatment methods (digging or pulling) within 35 feet of water courses with surface water present be treated to prevent rill and gully erosion and possible sediment delivery to steam courses. Erosion control treatment includes scattering seed and mulch (straw) to create flow disruption and surface soil stability. MR/MM 5 (page 33) reiterates that any mulch used must be free of weeds. This mitigation would not involve straw bales placed within any streams. The MBS may use other weed free mulches such as wood bark if it is available.
16	13	The use of goats to simply eat the targeted invasive plants can be an effective means of weed control. Other less toxic herbicides such as vinegar, which has stopped invasion of unwanted species targeted in the DEIS, are available. Contact NCAP for suggestions on, blackberries, English ivy, knapweed and other unwanted plants.	This comment resulted in consideration of use of goats as a cultural invasive plant treatment alternative. Goats can be an effective means of reducing biomass associated with invasive plants. Goats must remain on a site for a long period and a goat herder must remain on site full time to ensure safety and environmental protection (Briana Murphy presentation at the Oregon Vegetation Management Association 2014 Conference). Grazing to manage weeds on roadsides, trailheads, and larger infestations on the forest is limited because of the difficulty of maintaining and managing the animals. Invasive plants can compensate quickly after the grazing pressure is removed because their seeds are long-lived in the soil, and because they can rapidly increase flower stem production once grazing pressure is removed (R6 2005 FEIS page 3-84). The Forest Service could consider using goats as an invasive plant

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			treatment method in the future if an appropriate site is identified. This alternative was not developed for detailed study in this EIS because no sites appropriate for grazing have been identified and thus, no site-specific effects analysis could be conducted. A Forest Service Risk Assessment has not been prepared for the use of vinegar, and there are several reasons why this chemical could have unacceptable impacts: 1. Potential negative impacts on soil pH. 2. Not selective. 3. The amount needed to kill roots would likely affect root systems of adjacent plants and soil organisms. 4. Dish soap is often recommended to make vinegar more effective; dish soap is not an acceptable additive and does not meet Standard 18 (DEIS table 2).
16	14	USDA Forest Service should adequately consider the use of non---herbicidal controls or least toxic herbicides. Alternative weed control methods should be expanded in the EIS. Control techniques vary depending on the weed species being addressed. The Forest Service should consider implementing non---herbicidal alternatives. Most of the target invasive species noted in Table 5 & 6 can be effectively controlled by non---herbicide treatments. We encourage the use of alternatives, in additional to cultural, biological and mechanical weed control. Several alternative methods have been proven to produce positive results in stopping noxious weeds and other invasive species. For example, manual removal, as well as the use of tools and other machines, has fewer unforeseen impacts than herbicide application.	This comment does not warrant changes to the project or analysis. Consideration of non-herbicide methods has been given in the R6 2005 FEIS and the MBS 2005 EA, along with the current analysis (see Chapter 2 – invasive plant treatments common to all alternatives, DEIS pages 13-14, and alternatives descriptions, page 15-53) The MBS DEIS incorporated best available information on effective, integrated treatments for the target species found on the Forest. The integrated treatment notes discusses the non-herbicide methods that would be used alone or in combination with herbicides to effectively treat invasive plants. The focus on herbicide selection comes from the fact that most of the other methods were already studied and approved for use in the MBS 2005 EA. The MR/MM are intended to minimize risks and many layers of caution have been added to ensure that there will not be any unforeseen impacts. The intent is for the Forest Service to use the most cost effective combination of methods according to MR/MM that minimize risks from treatment and according to an implementation planning process that ensures treatment prescriptions will be appropriately applied on the ground. DEIS page 42 noted that if the target species population is not associated with a size, phenology, density or distribution that warrants herbicide use (alone or in combination with other methods), or if herbicide use does not substantially increase treatment efficiency, then non-herbicide methods would be favored. MR/MM 16 specifically favors hand pulling on roadsides posing higher risk of herbicide delivery to fish habitat and adjacent alluvial floodplains.

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16	15	The failure of the DEIS to present a full range of alternatives violates the National Environmental Policy Act (NEPA). The two action alternatives differ only in the use of aminopyralid. The DEIS should examine other alternatives that would use non---herbicide methods first.	This comment does not warrant changes to the project or analysis. The DEIS Chapter 2 described the range of alternatives considered, including 5 alternatives that were considered and not developed in detail (DEIS, pages 52-53).The scope of the analysis and range of alternatives is influenced by the purpose and need. An alternative requirement the use of non-herbicide methods first would not address the need for additional herbicide ingredients and application methods as described in DEIS Chapter 1. This EIS is tiered to the R6 2005 FEIS that considered a range of programmatic approaches to invasive plant management and specifically rejected the concept of "herbicides as a last resort." Non-herbicide methods would continue regardless of alternative selected, including no action (with the exception of mechanical treatment that was not addressed in the MBS 2005 EA.
16	16	The "No Action" alternative should compare the action alternatives to a true "no action" alternative, where no chemical herbicide weed control measures are used. The two action alternatives are not sufficiently different from one another to represent a "rigorous exploration of all reasonable alternatives," and therefore the USFS has violated NEPA.	This comment does not warrant changes to the project or analysis or further explanation. A "No Action" alternative was analyzed in the DEIS. FSH 1909.15 Chapter 14.2 discusses two interpretations of no action, including the case where no action equates to no change from current management direction or level of management intensity. As noted in CEQ 40 most asked questions: "To construct an alternative that is based on no management at all would be a useless academic exercise. Therefore, the "no action" alternative may be thought of in terms of continuing with the present course of action until that action is changed." Thus, in the present EIS, the No-Action Alternative would continue the present treatment approach. A no herbicide alternative was considered and rejected in the MBS 2005 DN
16	17	Full disclosure and analysis of all herbicide ingredients must be included in the EIS. Increased transparency will protect public health. We urge the Forest Service to analyze the risks of the inert ingredients in the herbicide formulas proposed for use. Have the effects of these inert ingredients been analyzed in order to comply with NEPA?	See section 3.1.5.1 and Appendix E for information about inert ingredients. Effects of surfactants were considered in the R6 2005 FEIS and have been considered in the DEIS effects analysis. Standard 18 requires that the Forest Service use adjuvants (e.g. surfactants, dyes) and inert ingredients reviewed in Forest Service hazard and risk assessments. Many of the inert ingredients are proprietary in nature and have not been tested on laboratory species. However, confidential business information (i.e. the identity of proprietary ingredients) was considered in the preparation of the herbicide risk assessments completed prior to 2004. Bakke's adjuvant hazard assessment was updated in 2007. One reason that the milestone formulation of aminopyralid is proposed and preferred is that labeled formulations contain no inert ingredients other than water and triisopropanolamine

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			(chemical name for the active ingredient in aminopyralid).
16	18	We support the proposal to post all herbicide treated areas. Plastic signs not less than 8.5" x 11" in size with 1" high red letters on yellow background should be posted at all locations where pesticides have been applied. The signs should be mounted at least 12" above the ground on 2" x 2" wood stakes driven 6" into the ground or stapled to trees larger than 12"in diameter (dbh). These signs should be spaced at all public access points to treated areas and along roads at a spacing not less than 1 sign per 100' of roadway. The signs should state: THE AREA BEHIND THIS SIGN HAS BEEN TREATED WITH name of the herbicide APPLIED ON ___ date. For more information contact the name of ___ District Ranger Station. The underlined italics in the sign wording above may be completed in the field printing neatly, using red indelible permanent felt tip ink pens (Sharpie Fine Pont or equal) by the field crew.	This comment does not warrant changes to the project or analysis. Adequate signing is required by standard 23. Warning and information signs will be placed at appropriate locations (defined in the public information plan) to inform the public, and forest workers of herbicide application dates and herbicide used. The distribution and frequency of signs would be determined by the location of the invasive plant treatment site. MR/MM 45-50 include notification and posting requirements for administrative and recreation sites (DEIS pages 38-39).
16	19	Modify timber harvest and construction contracts to monitor for noxious weeds. All timber sales and construction projects should require the contractor to monitor and remove noxious weeds for a minimum of 5---years and provide a written report certified by an approved botanist or State licensed horticulturist on the success of noxious weed control. This monitoring should continue until the site has stabilized and trees have been re---established to sufficient height to shade out and out-compete noxious weeds. Do timber harvest and construction contracts currently monitor for noxious weeds?	This comment does not warrant changes to the project or analysis. This recommendation is outside the scope of this treatment project. The MBS Best Management Practices for invasive plant prevention includes measures for survey and removal of invasive plants after ground disturbing activities. In some cases, this is part of a contract and in other cases is done by other means (e.g., KV plans). Post-treatment monitoring and relationship to invasive plant treatment is discussed in each project plan. Regardless of contract or other mechanism for project implementation, invasive plant treatments would be done according to the design, management requirements and mitigation measures for the selected alternative.
16	20	The DEIS does not adequately address effects on wildlife. On p. S---10 the DEIS dismisses effects on wildlife toxicity by stating the herbicides would be used in roadside areas where wildlife density is lower. Wildlife species would experience exposure on roadsides, and pesticides can leach into soil and contaminate water supplies and persist in soil for years.	The summary statement has been modified to clarify the conclusions of the wildlife effects analysis. The effects analysis assumes that an animal is directly sprayed, consumes an entire days' diet of contaminated food, or drinks contaminated water for an entire day. These scenarios far overestimate actual exposure levels. The management requirements and mitigation measures would further reduce the potential impacts on wildlife. The location of invasive plants (primarily on roads and within disturbed areas away from preferred habitats) may also reduce potential exposure to wildlife.

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16	21	According to the Material Safety Data Sheet for Clearview, which includes the herbicide aminopyralid as a main ingredient, this chemical has complications with fire and these concerns need to be addressed before proceeding with any application. For this reason, input is needed from fire and fire safety departments regarding this chemical application and fire dangers in Mt Baker---Snoqualmie. Specifically, the Material Safety Data Sheet for Clearview included warnings for Fire Fighting Measures and hazards arising from this substance or a mixture of this substance. The Forest Service should confirm that the fire safety departments are aware of this hazard.	This comment does not warrant changes to the project or analysis. Clearview is a Canadian formulation and would not be approved for use on the MBS. The MSDS includes warnings for firefighters about chemical fires, similar to other herbicides in use in Canada. Modeling assessments coupled with laboratory experiments have shown that the risk of airborne herbicide residues to workers is insignificant, even is the fire occurs immediately after herbicide application. McMahon, Charles and Parshall B. Bush. 1992. Forest Worker Exposure to Airborne Herbicide Residues in Smoke from Prescribed Fires in the Southern United States. Am. Ind. Hyg. Assoc. J. (53).
16	22	Requirement #3 (Table 9 page 33), pre---treatment briefings should not replace IPM trainings and/or pesticide applicator training. Applicators should be fully aware of health risk associated with pesticide use. We oppose the proposal to allow non---licensed applicators to apply pesticides under supervision by licensed applicators. All applicators should be licensed and properly supervised. Requirement #7 (Table 9, page 33), No herbicide applications would occur if there is a greater than 80 percent change of precipitation within 24 hours. Guidelines on precipitation should be based on the product label and/or third party scientific peer review studies in forest areas. Pesticide labels and safety data sheets may suggest a different recommendation regarding potential for rain. Consideration for public and wildlife safety should be considered along with product efficacy.	This comment does not warrant changes to the project or analysis. Forest Service policy requires that all Forest Service personnel who use apply general-use chemical pesticides on terrestrial or aquatic areas of the National Forest System be trained in the proper, safe, and effective use of the respective pesticides being applied for the management activity. Pesticide-use training and certification for Forest Service employees who use, or directly supervise the use of, restricted-use pesticides will be accomplished through an appropriate EPA-approved State program or a national Forest Service certification program. The R6 2005 ROD standard goes beyond this policy by requiring that herbicide applications to treat invasive plants in R6 must be conducted or directly supervised by a licensed applicator. Requirement #3 would not replace pesticide applicator training or certification requirements. Requirement #7 goes beyond the labels to reduce potential for surface run off containing herbicide. This measure is similar to measures taken for many years on the MBS and adjacent forests.
16	23	The chemical aminopyralid has been associated with contamination by manure of ungulates, persisting in soil and destroying food crops. This is a concern for Washington State's $40 Billion dollar agricultural industry. There is a potential for wildlife to consume pesticide---treated plants and spread the herbicide out of the treatment area. Concerns with the new pesticides are based on reports from Europe where the pesticide was ingested, passed, used as manure on crops and one year later damaged food crops. Newly proposed pesticides must be fully tested using third party peer reviewed studies.	The aminopyralid label addresses precautions for pasture and rangeland to prevent unintended consequences from aminopyralid residue in grass, hay and manure. US EPA addressed this issue in 2011. They noted key variables that influence this potential impact: large numbers of confined animals in the area; dependence on local forage that could have been treated with aminopyralid; and proximity to organic farms or gardens. On the MBS, aminopyralid would not be used in areas where there are confined animals. Wildlife would not be dependent on treated areas for

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			forage nor would a substantial portion of a free roaming ungulate's diet be composed of vegetation treated with aminopyralid. Organic farms and gardens are unlikely to be affected by herbicide use on the MBS given the remote locations, limited extent, and scattered distribution of invasive plants, and the type of herbicide use proposed. In their website www.manurematters.com, Dow Chemical states that "Reports of alleged garden or landscape plant damage due to aminopyralid have been rare in the United States. It is possible that manure from cattle or horses may contain aminopyralid, but only if aminopyralid was used to control weeds on pastures where the animals grazed or in hay taken from such pastures, and aminopyralid label directions regarding management of manure were not followed." Following the label would mitigate the risk of contaminated manure.
16	24	An additional request is to track, record comments, or keep a record of comments received in reference to the signage. These could be treated as public comment and posted on a website a tally of calls with exposure concerns or other concerns could be tracked.	NCAP et al provided this additional comment after the close of the comment period. We maintain records of public comments and our responses to individuals. Comment 9-1 provides an example of a letter sent to the MBS based on a person's visit to the Olympic NF and the Forest Service response. The Olympic National Forest also responded directly to the commenter. No tracking system exists to tally exposure concerns. The MBS receives few calls in reference to signage about herbicide treatments.
16	25	We stress that more information needs to be conducted on the pesticide aminopyralid and it's potential to be spread by ruminants. How will Forestry Service control for 'drift' beyond the treatment area by ruminant animals of this pesticide?	NCAP et al provided this additional comment after the close of the comment period. Following the label would mitigate the risk of adverse impacts from the manure of ungulate, ruminants or other animals eating contaminated vegetation, then excreting it. This concern applies to confined animals that depend on forage treated with aminopyralid. Wildlife would not be dependent on treated areas for forage nor would a substantial portion of a free roaming animal's diet be composed of vegetation treated with aminopyralid.
17	1	The Department of the Interior (Department) has reviewed the Draft Environmental Impact Statement (DEIS), US Forest Service (USFS), Mt. Baker-Snoqualmie Invasive Plant Management, Washington. The Department supports the Mt. Baker-Snoqualmie National Forest (MBS) in their efforts to reduce the potential spread of invasive plants on National Forest System lands and adjacent to our National Parks within the context of best management practices that are provided in detail in the DEIS, and	This comment generated minor corrections to the EIS. An updated accounting of pesticide use in the park for 2014 was not obtained. The 2013 estimates provided sufficient context for understanding the potential for cumulative effects from the MBS project combined with herbicide use the park.

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		which are designed to protect sensitive resources and minimize potential impacts to non-target species. We recommend the following edits for inclusion in the final EIS: 1. Please change references to Mt. Rainier or Mt. Rainier National Park to Mount Rainier throughout the document. 2. Page 80 refers to three chemicals used within the park (clopyralid, aminopyralid and imazapyr), and page 105 refers to the use of triclopyr. Please include triclopyr on page 80, and glyphosate, which the park uses small amounts of. Fluroxypyr has also been used in the park in limited amounts. Prior to publication of the FEIS, please consult with the Plant Ecologist for an updated accounting of pesticide use in the park.	
18	1	We have reviewed the Mount Baker-Snoqualmie National Forest Invasive Plant Treatment Draft Environmental Impact Statement (draft EIS). Our review was conducted in accordance with the EPA's responsibilities under the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act. Section 309 specifically directs the EPA to review and comment in writing on the environmental impacts associated with all major federal actions. Our review of the draft EIS considers the expected environmental impacts of the proposed action and the adequacy of the EIS in meeting the procedural and public disclosure requirements of NEPA. We are rating the draft EIS Lack of Objections (LO). In our April 2, 2012 scoping comments we recognized the Forests' need for improved effectiveness in eradicating, controlling and containing invasive plants. We also stated our belief that the alternative which best meets the project's purpose, "...to achieve the desired condition in the most effective manner possible while ...minimizing adverse impacts to people and the environment" would likely be the environmentally preferable alternative. Alternative 2, the Proposed Action, best meets the project's purpose and is the environmentally preferable alternative. Alternative 2 is preferable for the following reasons. • Best chance of controlling and eradicating populations of invasive plants, including the largest, densest and most aggressive noxious weed sites. For example, the first choice herbicide aminopyralid would not be available for treatment of over 2,400 acres of aggressive target species such as hawkweeds and knapweeds in Alternatives 1 or 3. Also, the total	This comment does not warrant changes to the project or analysis or further explanation. The environmentally preferred alternative will be identified in the Record of Decision.

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		cost for treating known infestations and restoring favorable vegetation would be least for Alternative 2. • Alternative 1 - No Action, and Alternative 3 - No Aminopyralid, have a greater chance of causing adverse impacts to people and the environment. Alternative 3, for example, would treat more acres with triclopyr than Alternative 2. Triclopyr is the only herbicide proposed for use that has Hazard Quotient values above I, the threshold of concern. Also, the use of aminopyralid - only allowed in Alternative 2 - would improve the Forest Service's ability to treat invasive plants near water, which would help restore riparian habitats. • Improved processes for new invader/Early Detection and Rapid Response, implementation planning, herbicide use decision criteria, and monitoring. • Improved Management Requirements and Mitigation Measures.	
12, 13	1	Thank you for the opportunity to comment on the Draft Environmental Impact Statement for the Mount Baker-Snoqualmie National Forest Invasive Plant Management Project. We support the Proposed Action – Alternative 2 as the preferred alternative to achieve considerably more cost-effective and timely treatments of invasive plants on the Forest. Alternative 2 addresses the need to treat invasive plants in wilderness areas in order to conserve the natural plant and animal communities and wilderness values of these designated areas to achieve desired future conditions. We support treatment of invasive plants in wilderness areas as non-native invasive plants colonize rapidly and can have adverse effects on natural ecosystem processes. As part of the Forest Invasive Plant Management Project, the ability to utilize a larger suite of herbicides is necessary for eradicating, controlling or containing the spread of invasive plants on the Forest. To this end, the addition of aminopyralid to the list of acceptable herbicides is fully supported. Our noxious weed control program has had considerable success in controlling invasive noxious weeds through the judicious use of aminopyralid. Aminopyralid is highly effective on many of the invasive plants currently known to occur on the Forest such as thistles, hawkweeds and knapweeds while posing a very low risk to fish and wildlife resources. The addition of the broadcast application method for herbicide treatments will also significantly contribute to the goal of controlling the spread of invasive plants in a cost-	This comment does not warrant changes to the project or analysis or further explanation.

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		effective manner, especially along road sides and for large infestations in other areas. While it is important to have access to appropriate herbicides and application methods, it is equally important to treat known and emerging invasive plant infestations in a timely manner. For example, in practicing the concept of "Early Detection, Rapid Response" our noxious weed control program has reduced the spread of invasive noxious weeds by treating infestations the same season in which they were discovered. The ability to take control action prior to seed set is critical to prevent increased spread of invasive plants and is therefore more cost-effective. We support an updated "Early Detection, Rapid Response" process which allows for treatment the same year as invasive plant infestations are discovered in Proposed Action - Alternative 2.	

Agency Letters in Full

King County Noxious Weed Control Program

King County

Department of Natural Resources and Parks
Water and Land Resources Division
Noxious Weed Control Program
201 South Jackson Street, Suite 600
Seattle, WA 98104-3855

November 17, 2014

To: Jennifer Eberlien, Forest Supervisor – Mount Baker-Snoqualmie National Forest
Attention: Forest Invasive Plant Management Project, Mount Baker-Snoqualmie National Forest

Thank you for the opportunity to comment on the Draft Environmental Impact Statement for the Mount Baker-Snoqualmie National Forest Invasive Plant Management Project. We support the Proposed Action – Alternative 2 as the preferred alternative to achieve considerably more cost-effective and timely treatments of invasive plants on the Forest.

Alternative 2 addresses the need to treat invasive plants in wilderness areas in order to conserve the natural plant and animal communities and wilderness values of these designated areas to achieve desired future conditions. We support treatment of invasive plants in wilderness areas as non-native invasive plants colonize rapidly and can have adverse effects on natural ecosystem processes.

As part of the Forest Invasive Plant Management Project, the ability to utilize a larger suite of herbicides is necessary for eradicating, controlling or containing the spread of invasive plants on the Forest. To this end, the addition of aminopyralid to the list of acceptable herbicides is fully supported. Our noxious weed control program has had considerable success in controlling invasive noxious weeds through the judicious use of aminopyralid. Aminopyralid is highly effective on many of the invasive plants currently known to occur on the Forest such as thistles, hawkweeds and knapweeds while posing a very low risk to fish and wildlife resources. The addition of the broadcast application method for herbicide treatments will also significantly contribute to the goal of controlling the spread of invasive plants in a cost-effective manner, especially along road sides and for large infestations in other areas.

While it is important to have access to appropriate herbicides and application methods, it is equally important to treat known and emerging invasive plant infestations in a timely manner.

For example, in practicing the concept of "Early Detection, Rapid Response" our noxious weed control program has reduced the spread of invasive noxious weeds by treating infestations the same season in which they were discovered. The ability to take control action prior to seed set is critical to prevent increased spread of invasive plants and is therefore more cost-effective. We support an updated "Early Detection, Rapid Response" process which allows for treatment the same year as invasive plant infestations are discovered in Proposed Action - Alternative 2.

Regards,

Steven Burke.

Steven Burke
Program Manager, King County Noxious Weed Control Program
Steven-J.Burke@kingcounty.gov

King County
Noxious Weed Control Board
201 South Jackson Street, Suite 600
Seattle, WA 98104-3855
206-477 9333

November 17, 2014

To: Jennifer Eberlien, Forest Supervisor – Mount Baker-Snoqualmie National Forest
Attention: Forest Invasive Plant Management Project, Mount Baker-Snoqualmie National Forest

Thank you for the opportunity to comment on the Draft Environmental Impact Statement for the Mount Baker-Snoqualmie National Forest Invasive Plant Management Project. We support the Proposed Action – Alternative 2 as the preferred alternative to achieve considerably more cost-effective and timely treatments of invasive plants on the Forest.

Alternative 2 addresses the need to treat invasive plants in wilderness areas in order to conserve the natural plant and animal communities and wilderness values of these designated areas to achieve desired future conditions. We support treatment of invasive plants in wilderness areas as non-native invasive plants colonize rapidly and can have adverse effects on natural ecosystem processes.

As part of the Forest Invasive Plant Management Project, the ability to utilize a larger suite of herbicides is necessary for eradicating, controlling or containing the spread of invasive plants on the Forest. To this end, the addition of aminopyralid to the list of acceptable herbicides is fully supported. Our noxious weed control program has had considerable success in controlling invasive noxious weeds through the judicious use of aminopyralid. Aminopyralid is highly effective on many of the invasive plants currently known to occur on the Forest such as thistles, hawkweeds and knapweeds while posing a very low risk to fish and wildlife resources. The addition of the broadcast application method for herbicide treatments will also significantly contribute to the goal of controlling the spread of invasive plants in a cost-effective manner, especially along road sides and for large infestations in other areas.

While it is important to have access to appropriate herbicides and application methods, it is equally important to treat known and emerging invasive plant infestations in a timely manner. For example, in practicing the concept of "Early Detection, Rapid Response" our noxious weed control program has reduced the spread of invasive noxious weeds by treating infestations the same season in which they were discovered. The ability to take control action prior to seed set is critical to prevent increased spread of invasive plants and is therefore more cost-effective.

We support an updated "Early Detection, Rapid Response" process which allows for treatment the same year as invasive plant infestations are discovered in Proposed Action - Alternative 2.

Regards,

Scott Moore
Chairman of the Board
King County Noxious Weed Control Board
s.moore@co.snohomish.wa.us

City of Seattle Major Watersheds

Comments on MBS Invasive Plant Treatment - Draft EIS

Sally Nickelson
Invasive Species Program Manager
City of Seattle Major Watersheds
10/23/14

I strongly support the Forest Service adopting the Proposed Action (Alternative 2). Invasive species pose one of the greatest risks to native ecosystem functioning, especially in the face of climate change. Neither Alternative 1 nor Alternative 3 will allow the Forest Service to adequately treat current and new invasive plants in a timely or cost-effective way, meaning that desired future conditions will be virtually impossible to achieve.

The addition of aminopyralid to the list of approved herbicides is a good one. It is extremely effective against many of the most invasive plants, including hawkweeds and thistles. Yet it poses lower risk to non-target organisms than some herbicides currently in use.

The use of broadcast spray is the only cost-effective way to treat large patches. The careful use of broadcast spray from a small truck-mounted sprayer is effective and safe. Integrating these additional tools into the integrated pest management approach will help increase the chance of success in controlling these non-native invasive plants that are often changing and degrading natural ecosystem functions, including wildlife habitat.

Treating invasive species in wilderness areas should be one of the highest priorities for the program. If invasions are allowed to continue, the value and function of the wilderness areas will be considerably degraded.

The use of EDRR and allowing staff to move quickly to develop site prescriptions and treating newly found patches as soon as possible is the only way that the Forest Service will ultimately control species that spread quickly. It greatly increases cost to wait for a year or more to initiate treatment.

Thank you for the opportunity to comment.

Sincerely,

Sally Nickelson

United States Department of the Interior

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
620 SW Main Street, Suite 201
Portland, Oregon 97205-3026

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ER14/0629

Electronically Filed

November 17, 2014

Phyllis Reed
Project Coordinator
2930 Wetmore Ave, Suite 3A
Everett, WA 98201

Dear Ms. Reed:

The Department of the Interior (Department) has reviewed the Draft Environmental Impact Statement (DEIS), US Forest Service (USFS), Mt. Baker-Snoqualmie Invasive Plant Management, Washington. The Department supports the Mt. Baker-Snoqualmie National Forest (MBS) in their efforts to reduce the potential spread of invasive plants on National Forest System lands and adjacent to our National Parks within the context of best management practices that are provided in detail in the DEIS, and which are designed to protect sensitive resources and minimize potential impacts to non-target species.

We recommend the following edits for inclusion in the final EIS:

1. Please change references to Mt. Rainier or Mt. Rainier National Park to Mount Rainier throughout the document.

2. Page 80 refers to three chemicals used within the park (clopyralid, aminopyralid and imazapyr), and page 105 refers to the use of triclopyr. Please include triclopyr on page 80, and glyphosate, which the park uses small amounts of. Fluroxypyr has also been used in the park in limited amounts. Prior to publication of the FEIS, please consult with the Plant Ecologist for an updated accounting of pesticide use in the park.

We appreciate the opportunity to comment.

Sincerely

Allison O'Brien

Allison O'Brien
Regional Environmental Officer

Washington Native Plant Society

Washington Native Plant Society
Appreciate, Conserve, and Study Our Native Flora
6310 NE 74th Street, Suite 215E, Seattle, WA 98115
(206) 527-3210; info@wnps.org

November 13, 2014

Phyllis Reed, Project Coordinator
Mt. Baker-Snoqualmie National Forest
2930 Wetmore Ave. Suite 3A
Everett, WA 98201

Also submitted electronically to plreed@fs.fed.us

Re: Forest Invasive Plant Treatment DEIS

Dear Ms. Reed,

As an organization committed to protecting Washington's native plants and their habitats, we are writing in support of Forest Invasive Plant Treatment DEIS Alternative 2, the preferred alternative analyzed in the Mount Baker-Snoqualmie National Forest (MBS) Draft Environmental Impact Statement. As Forest Service analysis indicates that this alternative provides the best protection for native plants within the forest, we believe it is the appropriate choice to ensure that the Forest Service has the ability to carry out its mission to "sustain the health, diversity, and productivity of the nation's forests and grasslands to meet the needs of present and future generations". We are assuming that the principles of Integrated Pest Management will be followed as part of this proposal. Sustaining the health and diversity of the forest requires controlling invasive plants and current methods used within the Snoqualmie-Mount Baker National Forest are not equal to the task, as evidenced by the increasing numbers of sites and acreage affected.

Washington Native Plant Society members monitor native plants and their habitats within the MBS. Our members participate in Weed Watcher programs and have observed increases of invasive species within the forest. We support adequately funding agencies that protect the health of the forest and are concerned about whether the Forest Service has the resources to ensure that validation of sites by invasive plant specialists, as specified in the DEIS, will be possible. We encourage the Forest Service to handle this concern in a way that ensures validation will be carried out in an expeditious manner as this will be critical to the overall success of the management plan.

Studying plants in their native habitats, known as botanizing, is an activity that has a long history. Rooted in the oral traditions of our state's First Peoples (predating the historical record), documented in the journal of botanist and explorer David Douglas, and continuing today on the web with the meticulous records of the Burke Herbarium and the citizen-science compiled WNPS plant lists, botanizing is a discipline worthy of recognition and protection on our federal lands. The observations of botanizers have contributed to the human knowledge base and across cultures for thousands of years. Ensuring the health of native plant habitats of our public forest lands is critical to the need of our members to carry on this worthy pursuit.

It is the mission of the Washington Native Plant Society to appreciate and protect the native plants of Washington. We advocate for the removal of introduced species that threaten native plants. We understand that invasive species management on public lands is required by Executive Order 13112[1] and appreciate the Forest Service actively responding to this problem. We appreciate the chance to work together on this important issue.

Thank you,

Rebecca A. Chaney

Rebecca Chaney, Conservation Chair
Washington Native Plant Society

Clay Antieau, President
Washington Native Plant Society

[1] http://www.gpo.gov/fdsys/pkg/FR-1999-02-08/pdf/99-3184.pdf

U. S. Environmental Protection Agency

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue, Suite 900
Seattle, WA 98101-3140

OFFICE OF
ECOSYSTEMS, TRIBAL AND
PUBLIC AFFAIRS

November 21, 2014

Forest Invasive Plant Treatment DEIS
Phyllis Reed, Project Coordinator
Mt. Baker Snoqualmie National Forest
2930 Wetmore Avenue, Suite 3A
Everett, Washington 98201

Re: U.S. Environmental Protection Agency comments on the Mount Baker-Snoqualmie National Forest Invasive Plant Treatment Draft Environmental Impact Statement. EPA Region 10 Project Number: 12-4159-AFS

Dear Ms. Reed:

We have reviewed the Mount Baker-Snoqualmie National Forest Invasive Plant Treatment Draft Environmental Impact Statement (draft EIS). Our review was conducted in accordance with the EPA's responsibilities under the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act. Section 309 specifically directs the EPA to review and comment in writing on the environmental impacts associated with all major federal actions. Our review of the draft EIS considers the expected environmental impacts of the proposed action and the adequacy of the EIS in meeting the procedural and public disclosure requirements of NEPA. We are rating the draft EIS Lack of Objections (LO). A copy of our rating system is enclosed.

In our April 2, 2012 scoping comments we recognized the Forests' need for improved effectiveness in eradicating, controlling and containing invasive plants. We also stated our belief that the alternative which best meets the project's purpose, "...to achieve the desired condition in the most effective manner possible while...minimizing adverse impacts to people and the environment."[1] - would likely be the environmentally preferable alternative.

Alternative 2, the Proposed Action, best meets the project's purpose and is the environmentally preferable alternative. Alternative 2 is preferable for the following reasons.

- Best chance of controlling and eradicating populations of invasive plants, including the largest, densest and most aggressive noxious weed sites. For example, the first choice herbicide aminopyralid would not be available for treatment of over 2,400 acres of aggressive target species such as hawkweeds and knapweeds in Alternatives 1 or 3. Also, the total cost for treating known infestations and restoring favorable vegetation would be least for Alternative 2.[2]
- Alternative 1 - No Action, and Alternative 3 - No Aminopyralid, have a greater chance of causing adverse impacts to people and the environment. Alternative 3, for example, would treat

[1] draft EIS, p. 2
[2] draft EIS, p. 89

more acres with triclopyr than Alternative 2. Triclopyr is the only herbicide proposed for use that has Hazard Quotient values above 1, the threshold of concern.[3] Also, the use of aminopyralid - only allowed in Alternative 2 - would improve the Forest Service's ability to treat invasive plants near water, which would help restore riparian habitats.[4]

- Improved processes for new invader/Early Detection and Rapid Response, implementation planning, herbicide use decision criteria, and monitoring.
- Improved Management Requirements and Mitigation Measures.

Thank you for this opportunity to comment and if you have any questions, please contact me at (206) 553-1601 or by electronic mail at reichgott.christine@epa.gov, or Erik Peterson, the lead reviewer for this project. Erik can be reached at (206) 553-6382 or peterson.erik@epa.gov.

Sincerely,

Erik Peterson for

Christine Reichgott, Manager
Environmental Review and Sediment Management Unit

Enclosure

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[3] draft EIS, p. 104
[4] draft EIS, p. 192

U.S. Environmental Protection Agency Rating System for
Draft Environmental Impact Statements
Definitions and Follow-Up Action*

Environmental Impact of the Action

LO – Lack of Objections
The U.S. Environmental Protection Agency (EPA) review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

EC – Environmental Concerns
EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce these impacts.

EO – Environmental Objections
EPA review has identified significant environmental impacts that should be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no-action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU – Environmentally Unsatisfactory
EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the Council on Environmental Quality (CEQ).

Adequacy of the Impact Statement

Category 1 – Adequate
EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis of data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2 – Insufficient Information
The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses or discussion should be included in the final EIS.

Category 3 – Inadequate
EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the National Environmental Policy Act and or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

* From EPA Manual 1640 Policy and Procedures for the Review of Federal Actions Impacting the Environment. February, 1987.

Mount Baker Snoqualimie Invasive Plant Treatment Project
Attn.: PHYLLIS REED, PROJECT COORDINATOR
2930 Wetmore Ave, Suite 3A
Everett, WA 98201