Henry M. Jackson Hydroelectric Project (FERC No. 2157)

Study Plan 8: Noxious Weed Inventory

Final Technical Report

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Public Utility District No. 1 of Snohomish County

City of Everett

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Acronyms and Abbreviations

BLM	Bureau of Land Management
City	City of Everett
District	Public Utility District No. 1 of Snohomish County
FERC	Federal Energy Regulatory Commission
FSS	Forest Service Sensitive
GIS	Geographic Information System
MBSNF	Mt. Baker-Snoqualmie National Forest
NFS	National Forest System
RM	River mile
SE	State Endangered
SOC	Species of Concern
SS	State Sensitive
ST	State Threatened
TES	Threatened/endangered/sensitive

USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
WHMP	Wildlife Habitat Management Plan
WNHP	Washington Natural Heritage Program

Cover Type Codes Used on Maps

DF	Deciduous Forest
GM	Grass/Meadow
MF	Mixed Deciduous/Coniferous Forest
NV	Non-Vegetated
OG	Old-Growth Coniferous Forest
RF	Riparian Forest
SS	Small Sawtimber Coniferous Forest

EXECUTIVE SUMMARY

A noxious weed inventory was conducted for the Henry M. Jackson Hydroelectric Project (FERC 2157) (Project) to document the occurrence of target species of noxious weeds and invasive non-native plants. The study area included surface lands within the Federal Energy Regulatory Commission (FERC) boundary for the Jackson Project; areas where Project operations, or Project-related maintenance, land use practices, or human activities could promote the introduction, establishment, and/or spread of noxious weeds; National Forest System lands within the riparian corridor between Culmback Dam and the Diversion Dam; and selected co-licensee properties outside the FERC Project boundary.

GIS was used to refine the overall inventory area into a set of weed survey sites, based on the intersection of high probability weed habitats and areas of potential effect, including reservoir fluctuation zones, forest management units, and Project-related recreation sites.

A total of approximately 1,089 acres of land were inventoried; incidental occurrences of weeds were recorded on an additional 386 acres surveyed for rare plants. Nineteen species of weeds were recorded, including Washington State Class B designates spotted knapweed (*Centaurea biebersteinii*), yellow hawkweed (*Hieracium caespitosum*), and unknown species of invasive hawkweed (*Hieracium* sp.). The Snohomish County Selected species Canada thistle (*Cirsium arvense*), bull thistle (*Cirsium vulgare*), invasive knotweed (*Polygonum* sp.), and tansy ragwort (*Senecio jacobaea*), also were documented. On National Forest System lands, eleven species of weeds tracked by the U.S. Forest Service were observed. Weeds occurred most frequently on habitats that receive regular ground and/or vegetation disturbance, including sites with vehicle traffic, vegetation maintenance, equipment use, and recreational activity.

1.0 STUDY OBJECTIVES AND DESCRIPTION

Public Utility District No. 1 of Snohomish County (District) and the City of Everett (City), co-licensees of the Henry M. Jackson Hydroelectric Project, FERC No. 2157 (Project), conducted a field inventory for noxious weeds in and near the Project area. As detailed in Revised Study Plan 8: Noxious Weed Inventory (Snohomish County PUD and City of Everett 2006a), the inventory focused on lands within the Project boundary and Wildlife Habitat Management Plan (WHMP) tracts. In addition, National Forest System (NFS) lands within the riparian corridor of the Sultan River bypass reach were surveyed.

The primary objective of the noxious weed inventory is to document the occurrence of target species of noxious weeds and invasive non-native plants within the study area. Ongoing Project operations involve several activities that may cause disturbance to soils and vegetation and could promote the establishment and spread of weeds. These activities include Project facility maintenance, road maintenance, and reservoir fluctuation. Project related activities such as use of recreation facilities could also contribute to soil and vegetation disturbance. The noxious weed inventory also summarizes information on factors that may contribute to weed invasion and spread in the study area. The inventory provides the basis for development of a weed management plan for the Project.

2.0 BACKGROUND INFORMATION

Noxious weeds and other invasive plant species can negatively affect native plant communities and wildlife. Currently, several species of noxious weeds and invasive nonnatives are present in the Jackson Project area; several of these species are managed by the co-licensees on specific sites. A variety of federal and state regulations and policies address the management of noxious weeds on private and public lands.

2.1 Federal Weed Law

The major federal authorities for management of non-native plants are the Plant Protection Act (Title IV of the Agricultural Risk Protection Act of 2000), the Amendment to the Federal Noxious Weed Act of 1974, and Executive Order 13112 on Invasive Species (1999). The Plant Protection Act addresses the need to manage plant pests and noxious weeds in order to protect agriculture, the environment, and the economy of the United States. The Act replaces the Federal Noxious Weed Act (FNWA), but incorporates the 1990 Amendment to the FNWA, which defines undesirable plants to include, but not be limited to, noxious weeds. Executive Order 13112 directs federal agencies whose actions may affect the status of invasive species to manage these species. An Invasive Species Council was established per the Order, and a national Invasive Species Management Plan was established by the Council in 2001.

The U.S. Forest Service (USFS) implements measures to prevent the introduction and control the spread of noxious weeds on National Forest System lands. USFS

management methods must comply with the objectives, standards, and guidelines of the Mt. Baker-Snoqualmie National Forest (MBSNF) Land and Resource Management Plan (Forest Plan) (USFS 1990, as amended), as well as federal law and direction. In 2005, an Environmental Assessment (EA) and decision notice on the proposed treatment of invasive plants and new invaders strategy were issued for the MBSNF (USFS 2005a and 2005b). The EA and new invaders strategy provide the current guidance and NEPA authorization for weed management on the Forest. Additional direction for the management of non-native invasives within Region 6 currently is provided in the Pacific Northwest Region's Invasive Plant Program Record of Decision (USFS 2005c). Region 6 policy on the use of native and non-native plants is provided in USFS (1994); MBSNF guidelines on plant movement are provided in Potash and Aubry (1997). National policy on the use of native and non-native plants is currently in draft form (FSM 2070; 71 FR 30375-30376).

2.2 State Weed Law

Washington Weed Law (Chapter 17.10 RCW) requires that noxious weeds be controlled to limit adverse economic effects on agricultural, natural, and human resources of the state. Noxious weeds are plants that, when established, are highly destructive, competitive, or difficult to control by cultural or chemical practices. The State Noxious Weed Control Board coordinates noxious weed control activities throughout the state via local weed districts and county noxious weed control boards. Management goals for noxious weed species may range from complete eradication to containment of the species within a currently infested area.

The State Noxious Weed Control Board updates its list of noxious weeds annually and categorizes the species into three classes (Chapter 16-750 WAC). Class A species are those noxious weeds not native to the state that are of limited distribution or are unrecorded in the state. Eradication of all Class A species is required by state law. State Class A species are listed on all County Class A weed lists.

Class B species are those noxious weeds not native to the state that are of limited distribution or are unrecorded in a region of the state, and that pose a serious threat to the region. These species are treated differently in different regions of the state, based on their distribution. In regions where a Class B species is of limited distribution or unrecorded, the species is designated by the state for 'control', which is defined under state law as prevention of seed production. In regions where a Class B species is already widespread (Class B non-designate species), control (i.e., management) is decided at the local weed board level, with containment as the primary goal. Thus, Class B designate species carry a state-mandated management requirement of control. Class B undesignated species are not mandated for control by the state, but may be so designated by the county.

Class C weeds may be widely established in Washington, or may be of particular interest to the agricultural industry. Control of these species is a local weed board option.

The State of Washington also maintains a monitor list of non-native species. Species may be included on the list for a variety of reasons including the need for information on distribution and biology, the need to verify occurrence, and the need to monitor reoccurrence. There is no regulatory or legal authority associated with the monitor weed list.

The Snohomish County Noxious Weed Control Board administers state weed laws at the local level on private, county, and state lands. Local weed boards are provided flexibility to determine local weed priorities for Class B non-designate and Class C species, and are responsible for enforcement of weed control responsibilities to ensure resource protection and uniform standards. Although primary responsibility for weed management is assigned to the landowner, the county weed boards facilitate implementation of management activities through technical assistance and education on noxious weed species, prevention strategies, and management methods.

3.0 METHODS

The study area for the noxious weed inventory included all surface lands within the FERC boundary for the Jackson Project; areas where Project operations, or Project-related maintenance, land use practices, or human activities could promote the introduction, establishment, and/or spread of noxious weeds; NFS lands within the riparian corridor between Culmback Dam and the Diversion Dam; and selected co-licensee properties outside the FERC Project boundary. The inventory was conducted on a subset of sites within the overall study area; the process for delineating the specific inventory sites is described below.

3.1 Prefield Review

Prefield review for the noxious weed inventory included compilation of existing information on noxious weed status and occurrence in the Project vicinity. Stakeholder input regarding species and areas of concern was reviewed and additional input was acquired from stakeholders regarding specific details of the survey protocol.

3.1.1 Target Weed Species

A list of target weed species was developed for the Jackson Hydroelectric Project based on review of the following sources of information: Revised Study Plan 8: Noxious Weed Inventory (Snohomish County PUD 2006a), the 2007 Washington State Noxious Weed List (Washington State Noxious Weed Control Board (NWCB) 2007a), the 2007 Snohomish County Noxious Weed list (Snohomish County NWCB 2007), City of Everett weed program data (City of Everett 2006), District weed survey data (Snohomish County PUD 2007), and information provided by the MBSNF (USFS 2007a and 2007b) and Snohomish County NWCB.

The list of target weed species includes species known or suspected to occur within the Project area that fall under one or more of the following management categories:

- State designated Class A species;
- Species designated Class B in the county;
- Other species selected by the county for control;
- Species currently managed and/or tracked by the City of Everett and the District;
- Two additional weed species requested by Snohomish County NWCB (pers. comm. Sonny Gohrman, Snohomish County NWCB, May 10, 2007); and
- Two additional weed species requested by the Forest Service (USFS 2006, USFS 2007, pers.comm. A.Risvold, North Zone Botanist, MBSNF, June 6, 2007).

It should be noted that some species of noxious weeds are already abundant within the county and have been determined by the state and/or county to be too widespread to be designated for management at this time.

Table 3-1 presents the list of target noxious weed species along with their documented occurrence and state, county, and USFS management status.

Currently, no Class A weed species are known from the Project area. The Class B designate species yellow hawkweed (*Hieracium caespitosum*) and perennial sowthistle (*Sonchus arvensis ssp. arvensis*) have been reported.

Two Class B undesignated species selected for control by Snohomish County have been documented in the Project area. Invasive knotweeds (one or more species from the four listed species of *Polygonum*) are present in the Lake Chaplain area in the vicinity of the Old Gaging Station and along the E-1000 road (north of Lake Chaplain and outside the Lake Chaplain Tract). Tansy ragwort (*Senecio jacobaea*) has been observed along portions of the power pipeline right-of-way, Powerhouse road, and in the Spada Lake WHMP tracts, including one wetland site.

Two Class C weed species occurring in the Project area have been selected for control by Snohomish County. Canada thistle (*Cirsium arvense*) and bull thistle (*Cirsium vulgare*) are present along roads within the Lake Chaplain and Spada Lake tracts, and along the power pipeline right-of-way.

The above-listed weed species are required to be controlled and currently are addressed under the District Vegetation Management Program and City of Everett weed management policy as described in the Preliminary Application Document (PAD; Snohomish County PUD and City of Everett 2005). The lands along the power pipeline right-of-way and the Lake Chaplain pipeline were inventoried and treated in 2004; these and other Project lands continue to be checked and treated. The City of Everett records locations of weed infestations and managed weeds on the Lake Chaplain Tract.

					Species documented on
Common Name	Scientific Name	State Status ^a	Snohomish County Status ^b	Project area ^{c,d, e}	MBSNF
Class A Weed Species					
None					
Class B Designates					
Yellow hawkweed	Hieracium caespitosum	Class B Designate	Class B Designate	Yes ^e	Yes
Perennial sowthistle	Sonchus arvensis ssp. arvensis	Class B Designate	Class B Designate	Yes ^e	-
Class B Weeds, Undesigna	ated				
Scotch broom	Cytisus scoparius	Class B	Undesignated	Yes ^{c, d, e}	Yes
Wild carrot	Daucus carota	Class B	Undesignated	Yes ^e	Yes
Herb Robert	Geranium robertianum	Class B	Undesignated	Yes ^{c, e}	Yes
Invasive knotweeds:				Yes ^{c, e}	Yes
Japanese knotweed	Polygonum cuspidatum	Class B	Class B, County Selected	Yes	Yes
Himalayan knotweed	Polygonum polystachyum	Class B	Class B, County Selected	Yes	Yes
Giant knotweed	Polygonum sachalinense (P. glandulifera)	Class B	Class B, County Selected	Yes	Yes
Bohemian knotweed	Polygonum X bohemicum	Class B	Class B, County Selected	Yes	Yes
Tansy ragwort	Senecio jacobaea	Class B	Class B, County Selected	Yes ^{c, d, e}	Yes
Class C Weed Species					
Butterfly bush	Buddleja davidii	Class C	Undesignated	Yes ^{c, d, e}	Yes
Canada thistle	Cirsium arvense	Class C	Class C, County Selected	Yes ^{c, d, e}	Yes
Bull thistle	Cirsium vulgare	Class C	Class C, County Selected	Yes ^{c, d, e}	Yes
Hairy willow-herb	Epilobium hirsutum	Class C	Undesignated	-	Yes
English ivy	Hedera spp.	Class C	Undesignated	Yesc	Yes

Table 3-1. 2007 Target Weed Species for the Jackson Hydroelectric Project

Common Name	Scientific Name	State Status ^a	Snohomish County Status ^b	Species documented in Project area ^{c,d, e}	Species documented on MBSNF ^f
Yellow archangel	Lamiastrum galeobdolon	Class C	Undesignated	-	Yes
Reed canarygrass	Phalaris arundinacea	Class C	Undesignated	Yes ^e	Yes
Other Non-native Weed Sp	ecies				
English holly	llex aquifolium	-	-	-	-
Elephant ear	Petasites japonicus	-	-	-	Yes
Himalayan blackberry	Rubus discolor	-	-	Yes ^d	Yes
Evergreen blackberry	Rubus laciniatus	-	-	Yes ^d	Yes

Note: Weed sighting reports also will be recorded on Project lands and other non-NFS ownerships for species in the following categories:

- Class A species,
- Class B designates in Snohomish County,
- and species selected for control by the County from the Class B undesignated and Class C species lists

Weed sighting reports also will be recorded on NFS lands for any species on the Washington State Class A, B, and C lists

- ^a Washington State Noxious Weed Control Board. 2007a. 2007 Washington State noxious weed list. <u>www.nwcb.wa.gov/weed_list/weed_list.htm</u>. Accessed March 30, 2007.
- ^b Snohomish County Noxious Weed Control Board, 2007. Noxious weeds in Snohomish County 2007: classes and status. <u>www1.co.snohomish.wa.us/Departments/Public_Works/Divisions/Road_Maint/Noxious_Weeds/weeds_list.htm</u>. Accessed May 8, 2007. Eradication of Class A weeds and control of Class B designates is required under Washington State weed law. Snohomish County selected Class B and Class C species are required to be controlled in the county. No management is required for Class B and C undesignated species not selected by the county.
- ^c City of Everett. 2007. Unpublished data from the Noxious Weed Program for City of Everett Lake Chaplain Watershed 2006. Compiled by J. Dreimiller, April 5, 2007.
- ^d Snohomish County PUD. 2007. Unpublished data on weed distributions and treatment activities, 1999-2004. Compiled by M. Schutt, April 20, 2007.
- ^e Snohomish County PUD and City of Everett. 2005. Pre-Application Document, Henry M. Jackson Hydroelectric Project, FERC No. 2157. December, 2005.
- ^f U.S. Forest Service. 2005a and 2005b: Proposed treatment of invasive plants and new invaders strategy (Forest Plan Amendment #26), Environmental Assessment and Decision Notice, USDA Forest Service, Mt. Baker-Snoqualmie National Forest, Mountlake Terrace, WA; and/or subsequent sighting data provided by USFS Botanist.

The co-licensees manage additional weed species for which control is not required under County NWCB mandate. These include the Class B undesignated species Scotch broom (*Cytisus scoparius*), wild carrot (*Daucus carota*), and herb Robert (*Geranium robertianum*); and the Class C species butterfly bush (*Buddleja davidii*) and English ivy (*Hedera spp.*); and where practical, the non-listed species Himalayan blackberry and evergreen blackberry (*Rubus discolor* and *R. laciniatus*, respectively). These species are currently managed along Project roads in the Lake Chaplain Tract, along the power pipeline right-of-way, and incidentally at locations on WHMP lands where the weed species are observed to conflict with resource management objectives. The Class C species reed canarygrass (*Phalaris arundinacea*) is not actively managed on Project lands, except for at Lost Lake, where one small patch was observed in 2007 during relicensing studies..

Two additional species were added to the list of target weed species at the request of the Snohomish County NWCB (pers. comm. S. Gohrman, Snohomish County NWCB, May 10, 2007). Hairy willow-herb (*Epilobium hirsutum*) is a Class C weed species often found in emergent wetlands that may be present in the county. Yellow archangel (*Lamiastrum galeobdolon*) is a new addition to the Class C list in 2007; this species is aggressive and is known to invade forested habitats.

The USFS requested the addition of two species to the target weed list. These species are not listed on the current Washington State noxious weed list: elephant's ear (*Petasites japonicus*) (USFS 2006, USFS 2007) and English holly (*Ilex aquifolium*) (pers. comm. A.Risvold, North Zone Botanist, MBSNF, June 6, 2007).

Table 3-1, Target Weed Species, presents those species known or suspected to occur in the Project area and most likely to be observed during the weed inventory. During the weed inventory, weed sighting forms also were completed on Project lands and other non-NFS lands for any species observed from the following Washington State and Snohomish County categories:

- Class A species,
- Class B designates in Snohomish County, and
- Species selected for control by the County from the Class B undesignated and Class C species lists.

On Project and non-NFS lands, sighting forms were not completed for non-native species that neither appear on the target weed list for the Project nor have any management requirements or policies in place via the state, county, City of Everett, or District (for example, oxeye daisy, *Leucanthemum vulgare*). These species were recorded on daily species lists.

On NFS lands, and Project lands immediately adjacent to NFS lands, weed sighting forms were completed for species on Table 3-1 and any other Washington State listed Class A, B, and C species that were observed.

Appendix A presents the 2007 noxious weed list for Washington State, showing Snohomish County designated, selected, and emphasis species. The list is supplemented with additional species of concern for the Jackson Project and the USFS.

3.1.2 High Probability Weed Habitat

The District GIS data layer COVER, edited September 2006, provided the Project area cover types. The following cover types were considered high probability habitat for noxious weeds for this inventory:

- Non-vegetated
- Grass/meadow (human-maintained)
- Mixed shrub/brush
- Right-of-way
- Slides (adjacent to other habitats on this list and/or intersecting with potentially affected sites listed below)
- Habitats immediately adjacent to potentially affected sites (listed below)

3.1.3 Sites Potentially Affected by Project Operations and Project-related Activities

Activities that may affect the occurrence and spread of noxious weeds include reservoir fluctuation, vegetation clearing and maintenance at Project facilities, road maintenance and use, ground-disturbing forest management activities such as commercial thinning and harvest, and project-related recreation activities with potential for ground disturbance, such as day use areas, trailheads, and unimproved trails. The following specific sites could potentially be affected by Project operations and Project-related activities:

3.1.3.1 Lake Chaplain Area

- Harvested and commercially thinned units within the WHMP tract, focusing on landings, yarding corridors, spur roads
- Roads within the WHMP tract
- Chaplain Marsh: northern, western, and southern shorelines adjacent to roads used to access WHMP tracts.
- River access sites at Diversion Dam Road, Old Gaging Station, Horseshoe Bend, and Powerhouse (northwest side of river).
- Lake Chaplain shoreline

3.1.3.2 Lost Lake

- Lake shoreline
- Recreation site: lake access, boat launch, trails, fishing platform area
- Roads accessing recreation site and WHMP tract

3.1.3.3 Diversion Dam

- River access site at dam
- River access trail along the lower Diversion Dam Road

3.1.3.4 Project Facility Lands Area

- Habitats at Powerhouse site
- Power pipeline right-of-way, 3.7 miles to power tunnel
- River access on DNR lands near powerhouse
- Transmission line on District property
- Trout Farm Road river access site

3.1.3.5 Spada Lake Area

Culmback Dam vicinity

- Project facilities, roads, and disturbed habitats in vicinity of Culmback Dam, including face of dam
- North Shore Road to North Shore Recreation Site (Site 8)

Spada Reservoir Shoreline

• Reservoir shoreline/fluctuation zone plus adjacent wetlands 9-73 and 9-95

Spada Lake Tract

- Harvested (none) and commercially thinned units, focusing on landings, yarding corridors, spur roads
- Roads including Culmback Dam Road, South Shore Road to current point of closure, and other road segments
- Recreation sites 1-5, at Olney Pass, South Fork, South Shore, Nighthawk, and Bear Creek
- Wetlands 9-105 and 9-119 near South Shore recreation site.

3.1.3.6 Williamson Creek Area

• Existing roads (abandoned) along Williamson Creek

3.1.3.7 Riparian Corridor of the Sultan River between Culmback Dam and Diversion Dam and Forest Road 6122 (NFS lands)

• Riparian corridor along approximately 5-mile bypass reach, where safely accessible from the following four access trails:

River Mile (RM) 15.5, the Forest Road 6122 river access trail

RM 14.3, the Stringer Bridge

RM 11.2, Big Four Creek

RM 9.7, the Diversion Dam

• Forest Road 6122 on NFS lands, as far as river access trail

Sites with documented weed infestations were included in the above-listed areas of potential Project effects.

3.1.4 Noxious Weed Inventory Sites

Using GIS, the specific sites of intersection between high probability weed habitats and areas of potential effect were mapped. In addition, buffers were applied to project features such as roads, reservoir shoreline, and recreation sites. These buffers were included in the survey to pick up adjacent habitats that may be subject to weed invasion. A buffer of 25 feet was provided around disturbed habitats associated with Project features. Roads and the power pipeline were buffered by 25 feet on each side of the centerline. A 50-foot buffer was surveyed along the northern, western, and southern shorelines of Chaplain Marsh, where it is adjacent to roads.

Sites currently mapped in GIS as point locations, such as recreation access sites along the Sultan River, were given a nominal one acre polygon; the actual area surveyed at each of these sites was based on the disturbed area observed at the site and was recorded on field forms and used to update the GIS map.

Recently harvested and commercially thinned units (from 1990 to 2006) were included in the inventory because of the ground disturbance associated with these activities. Within the units, spur roads, landings, and yarding corridors were targeted for survey.

Through the prefield review process, several sites were identified to have potential for both noxious weed and rare plant occurrence. These include Spada Lake shoreline, NFS lands within the Sultan River bypass reach, Lost Lake, Chaplain Marsh, and both formal and informal recreation and river access sites, totaling approximately 208 acres. These sites were surveyed for special status plants and weeds during the same survey visit. Surveys of the Spada Lake and Lost Lake shorelines, and the Sultan River bypass reach were conducted by teams of two, for safety reasons; this teaming facilitated conducting both plant surveys during the same visit.

3.2 Survey Protocol

3.2.1 Survey Timing

The noxious weed inventory was conducted between June 25 and September 5, 2007. On sites where weeds and special status plant surveys were combined, the surveys were scheduled to maximize identification of the expected rare plants. The majority of weed species can be identified over the entire summer season, which allowed flexibility in the timing of the weed inventory.

3.2.2 Surveyor Qualifications

Surveys were conducted by botanists or biologists with experience in plant identification using technical keys for Pacific Northwest flora.

A brief orientation was conducted for field personnel to review the target noxious weed and invasive plant species known or expected to occur at the Jackson Project. Identification characteristics of target species and look-alike species were reviewed. Survey protocol and field forms were reviewed prior to beginning field surveys to promote consistency in reporting of data. Field orientation also included review of the special status plant sighting forms, cultural species plant lists, and weed vectors.

3.2.3 Survey Protocol

The inventory protocol was based on the requirements outlined in Revised Study Plan 8 (Snohomish County PUD and City of Everett 2006). Surveyors followed the intuitive controlled survey method as defined by Whiteaker, et al. (1998):

"The surveyor traverses through the project area enough to see a representative cross section of all major habitats and topographic features, looking for the target species while en route between different areas. Most of the project areas will have been surveyed. When the surveyor arrives at an area of high potential habitat, a complete survey for the target species should be made."

Individual sites to be surveyed were selected using GIS data related to the presence of high probability weed habitat and potential disturbance. Additional sites of high probability habitat were identified by the surveyors during the field work and were incorporated into the inventory.

Surveyors were instructed to manually remove very small isolated infestations (one to a few individuals) of easily pulled target weed species after completion of data collection. Pulled plants were bagged and removed from the site. This treatment activity was recorded on the field forms.

3.2.4 Survey Forms

A Jackson Project daily noxious weed survey form was used to summarize the individual sites inventoried by each surveyor each day (Appendix B). The daily weed survey form consists of a listing of the survey site(s) visited, a list of individual sighting forms completed for each site, and a map of each survey site location. A daily species checklist was completed for each site, summarizing all plant species observed, including culturally important species.

Each noxious weed population occurrence was reported on an individual noxious weed sighting form (Appendix B). The MBSNF invasive plant inventory form was completed for weed sightings on NFS lands. For other ownerships, the Jackson Project sighting form was used. This form is modified from the draft Washington State weed inventory field form (Washington State NWCB 2007b). GPS coordinates were recorded for each infestation, whenever possible, and/or the location was noted a 1:24,000 USGS quadrangle map, GIS-generated map, or orthophoto.

Sighting forms were completed for encountered populations of the species on Table 3-1, Target Weed Species. On NFS lands, sighting forms also were completed for any species encountered from the Washington State Class A, B, and C lists. On non-NFS lands, sighting forms also were completed for any species on the Washington State Class A list, Snohomish County B designate species, and any other species selected for control by Snohomish County. A separate sighting form was completed for each species at a site.

For this study, the typical minimum size polygon to be mapped for an infestation was 0.1 acre. In the case of extremely small populations and isolated individuals, point locations were recorded. For lower category weed species that occurred over large areas, such as Scotch broom within the power pipeline right-of-way, or blackberry within a harvest unit, large polygons were used to record the infestation.

Information on possible relationships between Project operations and Project-related activities and the weed infestation's location and potential spread were noted. Occurrences of noxious weed species were entered into GIS and reported to the co-licensees, Snohomish County NWCB, USFS (for NFS lands). Surveyors were instructed to report incidental occurrences of special status plant species on rare plant sighting forms, including marking locations using GPS and topographic maps/aerial photos. A comprehensive daily species list was recorded for each survey site. This information was collected, in part, to document the presence of culturally important species; individual plant/population locations were not noted.

3.3 Variance from Revised Study Plan 8

The Noxious Weed Inventory Plan was developed based on the criteria included in Revised Study Plan 8 (RSP 8). Three aspects of the detailed inventory plan vary slightly from the study plan:

- A single list of target species was developed for the Project, reflecting those weed species known from the area and/or expected to occur at the Project. Other non-native invasives encountered during the inventory were recorded in accordance with two different supplemental lists, based on land ownership. These lists reflect the different management policies implemented by the USFS on NFS lands and by state and local weed boards on private and other non-federal lands.
- Two sets of weed sighting forms were used. The USFS weed occurrence form was used for NFS lands. A Jackson Project weed occurrence form was used for all non-NFS lands. This form is modified from a draft Washington State weed inventory field form prepared by the Washington State Noxious Weed Control Board.
- Species of cultural interest were recorded as present/absent on daily plant species checklists. Tree species with diameters greater than 36 inches at breast height were also noted when present.

These minor changes to RSP 8 were described in detail in the Draft Noxious Weed Inventory Plan which was submitted to stakeholders on June 22, 2007. Comments were received from the USFS on June 29, 2007, and were incorporated into the final Noxious Weed Inventory Plan dated July 30, 2007.

Three small road segments designated for inventory in the Noxious Weed Inventory Plan were not surveyed due to difficulty of access and time limitations. These segments include about 500 linear feet of the abandoned 6122110 road located south of old-growth unit 9-112; about 300 feet of the abandoned KM road just north of Olney pass and west of unit 9-150; and about 1000 feet of abandoned road in the 6126114 road system above the southwestern portion of Williamson Arm.

4.0 RESULTS

4.1 Sites Surveyed

Figure 4-1 presents the maps of sites inventoried for noxious weeds and other invasive non-native species. Table 4-1 displays the acreage of inventory sites by Project feature and location.

The noxious weed inventory covered a total of 1,089 acres. In the Lake Chaplain area, survey sites included about 331 acres of timber management units harvested or commercially thinned since 1990, 76 acres of roads, 70 acres of river access sites, 15 acres of shoreline at Lake Chaplain, and 12 acres at Chaplain Marsh. Surveys in the Lost Lake area covered the lake shoreline, the recreation site, and access road.

In the Project Facilities area, surveys were conducted on 63 acres of disturbed habitats at the Powerhouse, transmission line, and power pipeline right-of-way. Thirty acres of roads were surveyed, as well as 5.5 acres of habitat at river access sites, including the Trout Farm Road site.

Location	Site Features	Acres ¹
Lake Chaplain Area		
(Including Diversion Dam area)	Lake Chaplain Shoreline	15.4
	Chaplain Marsh	12.1
	Commercially Thinned and Harvested Units	330.6
	Roads	75.7
	River Access Sites	69.8
Lost Lake	Shoreline	2.3
	Recreation Site and Road	5.5
Project Facilities Area	Habitats	39.4
	Power Pipeline ROW	22.2
	Roads	30.2
	Transmission Line	1.1
	DNR River Access near Powerhouse	1.9
	Trout Farm Road River Access Site	3.6
Spada Lake Area	Shoreline and Wetlands (9-73 and 9-95)	61.9
	Wetlands (9-105 and 9-119)	9.5
	Project Facilities at Culmback Dam	10.8
	Recreation Sites 1-5	16.1
	Commercially Thinned Units	238.3
	Roads	77.4
	North Shore Recreation Site 8	2.2
Williamson Creek Area	Abandoned Roads	18.9
Riparian Corridor of the Sultan River, Culmback Dam to Diversion Dam, NFS Lands	Riparian Corridor and Access Trails ²	
	Forest Road 6122 River Access Trail	6.2
	Forest Road 6122 River Access	6.9
	Forest Road 6122	4.4
	EK-92 Road to Stringer Bridge (abandoned)	11.5
	Stringer Bridge River Access	6.2
	Big Four River Access	8.3
	Diversion Dam River Access	0.8
Total Acreage Noxious Weed Inventory Sites		1089.2

Table 4-1. Acreage of Noxious Weed Inventory Sites

¹ Note: Table acreages are derived from GIS and may vary from field estimates recorded on data forms.

² Acreage of NFS ownership shown. Additional areas surveyed are included in Lake Chaplain Tract River Access totals. Diversion Dam: 8.9 acres on co-licensee lands; Big 4: 1.7 acres on WDNR lands; Stringer Bridge access road: 3.6 acres on WDNR lands; Forest Road 6122: 2.7 acres on District lands.

Noxious weed inventory of the Spada Lake area focused on the reservoir shoreline and adjacent wetlands (71 acres), Project recreation sites (18 acres), roads (77 acres), and Project facilities at Culmback Dam. Surveys also were conducted on 239 acres of commercially thinned timber management units. In the Williamson Creek area, 19 acres of abandoned forest management roads were surveyed.

The inventory included an estimated 22 acres on NFS lands along the riparian corridor of the Sultan River bypass reach at four river access sites, 18 acres of NFS lands along the Forest Road 6122 river access trail and abandoned EK-92 road at the Stringer Bridge access site, and 4.4 acres along Forest Road 6122.

Sites surveyed for both noxious weeds and special status plants include the NFS lands within the Sultan River bypass reach, the Spada Lake shoreline, Lost Lake shoreline, Chaplain Marsh, and formal and informal recreation and river access sites, totaling approximately 208 acres. Incidental sightings of weeds were recorded on the remaining 386 acres surveyed for rare plants.

4.2 Plant Species Observed

A list of vascular plant species was compiled for each noxious weed and special status plant survey site. The master list of all plant species observed during both studies is provided in Appendix C. Copies of full species lists for each survey site, including notes regarding large diameter trees, are provided in Appendix D (electronic files; by request).

Three hundred and seventeen species of vascular plants were observed. This total included 16 species of trees, 55 species of shrubs, 67 species of grasses and grass-like plants, 19 species of ferns and fern allies, and 160 species of forbs.

Nineteen species of weeds were recorded during the noxious weed inventory and special status plant survey. Three species of Washington State Class B designate weeds were recorded. These include the following:

- Spotted knapweed (Centaurea biebersteinii),
- yellow hawkweed (*Hieracium caespitosum*), and
- unknown species of non-native hawkweed (*Hieracium sp.*).

Four weed species selected for control by Snohomish County were recorded:

- Canada thistle (*Cirsium arvense*),
- bull thistle (*Cirsium vulgare*),
- invasive knotweed (Polygonum sp.), and
- tansy ragwort (*Senecio jacobaea*).

Five Class B species, undesignated in Snohomish County, were observed:

- Scotch broom (*Cytisus scoparius*),
- wild carrot (*Daucus carota*),
- herb Robert (Geranium robertianum),
- hairy cat's ear (*Hypochaeris radicata*), and
- oxeye daisy (*Leucanthemum vulgare*).

The following Class C weed species were recorded:

- butterfly bush (Buddleja davidii),
- common St. Johnswort (*Hypericum perforatum*),
- yellow archangel (Lamiastrum galeobdolon), and
- reed canarygrass (*Phalaris arundinacea*).

Three additional species of concern to the co-licensees or USFS were observed:

- English holly (*Ilex aquifolium*),
- Himalayan blackberry (*Rubus discolor*), and
- evergreen blackberry (*Rubus laciniatus*).

4.3 Noxious Weed Distribution by Geographic Area

Figure 4-2, Noxious Weed Locations, shows the general locations of weed infestations, by species, across the inventory area. Table 4-2 presents the species of noxious weeds and invasive non-natives observed and summarizes the number of infestations recorded for each species in each geographic area. Field inventory data are provided in Appendix E (electronic copy, by request).

Weed species were recorded on the majority of sites visited during the weed inventory. Seven commercially thinned (cable) timber management units in the Spada Lake Tract and one previously harvested unit in the Lake Chaplain Tract were the only sites in the weed inventory with no weed detections. Three old growth sites (Spada and Williamson tracts), one wetland (Lake Chaplain Tract), and four timber management units proposed for harvest by 2020 (Lake Chaplain Tract) were the only locations in the rare plant survey that did not support noxious weeds.

A total of 520 noxious weed infestations were recorded during the weed inventory and incidentally during the rare plant survey. The majority of weed infestations (313) are

very small populations, consisting of one or a few individuals in an isolated patch, generally less than 0.10 acre, and often less than 0.01 acre. Linear infestations, such as those occurring along roadsides, trails, and reservoir shorelines, total 133. These vary in size from about 0.1 acre to several acres. Larger map units were used for widespread infestations and infestations of non-regulated weeds that occurred within large, defined survey sites such as timber harvest units, cover type polygons, or surveyor-defined polygons. A total of 74 unit-based infestations were recorded, varying in size from a few to over 30 acres.

During the inventory, sixty small weed infestations were treated by the surveyors, primarily by pulling the plant and roots out of the ground. Because many species can continue to produce seeds after being pulled, most of the species were bagged and removed from the site; evergreen and Himalayan blackberry were typically bundled and left in a high, dry spot to dessicate. Four additional sites were treated by City or District staff including the knotweed site at the Old Gaging Station, and three weed infestations in the Lost Lake Tract¹.

4.3.1 Lake Chaplain Area

Within the Lake Chaplain area, roads, Project facilities, river access sites, Chaplain Marsh, and previously harvested and commercially-thinned timber management units were inventoried for noxious weeds. Weeds were also noted incidentally within units proposed for commercial thin or harvest by 2020.

4.3.1.1 Timber Management Units and Roads

A total of 17 timber management units harvested or commercially thinned since 1990 were inventoried in the Lake Chaplain area. The most commonly observed weed species was evergreen blackberry, which was present in all but one unit. Himalayan blackberry was observed in all but three units, and bull thistle was recorded in eleven of seventeen units. Yellow hawkweed and tansy ragwort were recorded in three units each; Canada thistle was observed in two units. Reed canarygrass was noted in several units, herb Robert and butterfly bush were recorded in three units each, and Scotch broom was present in one unit. Most of the recently harvested and thinned units supported three to four species of weeds; one ground-harvested unit had a total of eight weed species. In addition to the target weed species, most of the harvested units also supported one or more of the invasive non-native species common St. Johnswort, hairy cat's ear, oxeye daisy, and English holly.

Incidental sightings of weeds were reported from 12 of 16 timber units proposed for harvest or commercial thin between now and the year 2020. Most of the units supported

¹ Note that many additional weed infestations were treated by the District and City during the summer of 2007 through their ongoing programs of mowing and vegetation maintenance along roads and Project facilities. This report notes only the specific sites that were treated in relation to the current study. Refer to the PAD for additional information on weed management at the Project.

		Lake Chaplain Area and Diversion		Project Facilities Area, Power Pipeline ROW,	Spada Lake Area, Rec Site	Williamson	NFS Lands in Sultan River Bypass Reach and Forest	
Scientific Name	Common Name	Dam Area	Lost Lake	Trout Farm	8, and Roads	Creek Area	Road 6122	Total
Buddleja davidii	butterfly bush	12	0	3	0	0	0	15
Centaurea biebersteinii	spotted knapweed	0	0	0	1	0	0	1
Cirsium arvense	Canada thistle	14	0	7	20	0	5	46
Cirsium vulgare	bull thistle	26	0	12	25	4	1	68
Cytisus scoparius	Scotch broom	4	0	7	1	0	1	13
Daucus carota	wild carrot	0	0	2	1	0	0	3
Geranium robertianum	herb Robert	14	1	5	4	0	1	25
Hieracium caespitosum	yellow hawkweed	19	0	5	3	1	0	28
Hieracium sp. (non-native)	invasive hawkweed	1	0	0	1	0	0	2
Hypericum perforatum ¹	common St. Johnswort	n/a	n/a	n/a	1	n/a	2	3
Hypochaeris radicata ¹	hairy cat's ear	n/a	n/a	n/a	1	n/a	3	4
llex aquifolia ¹	English holly	n/a	n/a	n/a	0	n/a	1	1
Lamiastrum galeobdolon	yellow archangel	0	0	1	0	0	0	1
Leucanthemum vulgare ¹	oxeye daisy	n/a	n/a	n/a	1	n/a	4	5
Phalaris arundinacea	reed canarygrass	26	1	9	25	3	1	65
Polygonum sp. (invasive)	invasive knotweed	1	0	0	0	0	0	1
Rubus discolor	Himalayan blackberry	42	1	17	27	2	2	91
Rubus laciniatus	evergreen blackberry	62	3	14	36	6	6	127
Senecio jacobaea	tansy ragwort	8	0	7	6	0	0	21
Total number of weed infestations per geographic area		229	6	89	153	16	27	520
Total number of target weed species per geographic area		12	4	12	15	5	11	
Total number of acres surveyed per geographic area		504	8	98	416	19	44	1089

Table 4-2. Weed Species and Number of Infestations by Geographic Area

¹ Species of concern to USFS; presence recorded on NFS and immediately adjacent lands only.

only a single weed species, evergreen blackberry. Herb Robert was detected in a single unit. English holly was observed in most of these units; however, other non-native invasives were not recorded.

Over 12 miles of roads were surveyed in the Lake Chaplain area, including Lake Chaplain Road, which is open to the public much of its length, and a series of forest management roads that are gated to the public. Ten species of noxious weeds were recorded. The most commonly observed weeds were evergreen blackberry and Himalayan blackberry, which were present on almost every road segment. Canada thistle and bull thistle were frequently observed, typically in scattered infestations and along about half of the surveyed road segments. Yellow hawkweed and unknown invasive hawkweeds were observed along more than half of the surveyed segments, including the Lake Chaplain Road, portions of the Swamp Road, and roads along the northwestern, northern, and southern shorelines of Lake Chaplain. Tansy ragwort was observed along three road segments, herb Robert on two segments, and reed canarygrass on eight road segments. Other non-native invasives were frequently observed along the Lake Chaplain roads, including common St. Johnswort, hairy cat's ear, oxeye daisy, and English holly.

4.3.1.2 Lake Chaplain Shoreline

Six noxious weed species were recorded during the boat survey of the Lake Chaplain shoreline. Yellow hawkweed and unknown species of invasive hawkweed were found in small patches along the northeastern, northwestern, and southern shorelines. Canada thistle was found at a single location; evergreen and Himalayan blackberry were observed in small patches at a small number of locations around the lake. The most abundant weed along the shoreline was reed canarygrass. This species is present in dense stands along the shallow water areas in the northeastern corner of the lake, and scattered in small patches around the remainder of the shoreline. The non-native invasives common St. Johnswort, hairy cat's ear, and oxeye daisy were also detected along the Lake Chaplain shoreline.

4.3.1.3 Chaplain Marsh

Chaplain Marsh is dominated by native wetland species; reed canarygrass is the only target weed species that was present in the emergent wetland portion of the marsh. Several small clumps of reed canarygrass were observed in the southern end of the marsh; it is also present along the western and northern edges of the marsh. Three other weed species are present along the transition of the marsh to the forested border, particularly along the western edge of the wetland. Herb Robert, evergreen blackberry, and Himalayan blackberry all occur in small patches between the marsh and Lake Chaplain Road. The non-native invasive species English holly was also observed in the forested habitat between the road and the western edge of the marsh.

4.3.1.4 Diversion Dam Area

A river access trail off the Diversion Dam Road leads to the Sultan River upstream of Horseshoe Bend. Evergreen blackberry was observed along the upper part of this trail. At the Diversion Dam site, District and City of Everett property was surveyed, including the river access sites both upstream and downstream of the dam. Yellow hawkweed was observed upstream of the dam on a gravel bar along the left bank of the river. Canada thistle and bull thistle are present both up- and downstream of the dam. Evergreen blackberry, Himalayan blackberry, and reed canarygrass also are present scattered along the riverbank above and below the dam. The Diversion Dam Road exhibited small populations of Canada thistle, yellow and unknown hawkweed species, herb Robert, reed canarygrass, and both evergreen and Himalayan blackberry.

4.3.1.5 River Access Sites

The river access site at the Old Gaging Station is the only known location in the study area of invasive knotweed (*Polygonum* sp.). The site is currently under management by the City of Everett and was treated during summer 2007. No above-ground growth of knotweed was evident on the inventory date. Other weeds observed at the Old Gaging Station were herb Robert, evergreen blackberry, and Himalayan blackberry. Other invasive species at the site include hairy cat's ear and oxeye daisy.

The Powerhouse river access site consists of the northern segment of the Powerhouse Road from the Sultan River north to the Lake Chaplain Road, and adjacent shrub habitat. Eight target weed species were observed in this habitat, including butterfly bush, Canada and bull thistle, Scotch broom, yellow hawkweed, reed canarygrass, and both evergreen and Himalayan blackberry. The invasive species common St. Johnswort, hairy cat's ear, and oxeye daisy are also present at this site.

4.3.2 Lost Lake

Noxious weed surveys were conducted of the Lost Lake shoreline including its floating bog, the recreation access site, and approximately 3,500 feet of gated road accessing the lake. The road segment is located primarily within the Lost Lake Tract, but also includes a small piece of road within the adjacent Lake Chaplain Tract. Four weed species were observed at these sites. The shoreline of the lake was notably free of most of the target weed species. One small clump of evergreen blackberry and one small stand of reed canarygrass were observed on the eastern shoreline. District staff treated both of these weed infestations during August 2007. The blackberry was dug out and removed; the reed canarygrass seed heads were cut, bagged, and removed from the site.

Along the Lost Lake access road, one small patch of herb Robert was noted. This patch has been pulled by District staff for several years, and was treated by hand-pulling again in 2007. Both Himalayan and evergreen huckleberry occur intermittently along the road margins. Other non-native species observed along the road include common St. Johnswort, hairy cat's ear, and oxeye daisy.

4.3.3 Project Facilities Area, Power Pipeline ROW, and Trout Farm Road

Weed inventory of the Project Facilities area included the Powerhouse site, adjacent shrub habitats, the transmission line on District property, the power pipeline right-of-way, plus the river access sites on DNR lands on the northwest bank of the river. The Trout Farm Road river access site was included in this geographic group. Target weeds observed in this area totaled 12 species. Weed species not detected in this area include spotted knapweed and invasive knotweed. All other target weed species, plus the four additional USFS species of concern on NFS lands, are present in one or more of the surveyed sites in this area.

The shrub and roadside habitats at the Powerhouse, adjacent roads, transmission line, and along the power pipeline right-of-way support the largest number of weed species and infestations. Butterfly bush, both species of thistle, Scotch broom, wild carrot, reed canarygrass, and both blackberry species are present at these sites. Scattered infestations of tansy ragwort were observed at both the Powerhouse site and along the upper power pipeline right-of-way (between Horseshoe Bend and the tunnel portal). Herb Robert was detected at the DNR river access site. Yellow hawkweed was noted at the DNR river access and along the power pipeline right-of-way; an unknown species of invasive hawkweed was also observed along the right-of-way, but was not documented independently of yellow hawkweed with which it was growing.

Five weed species were observed at the Trout Farm Road river access site. Reed canarygrass is present along the river bank at this site. Evergreen and Himalayan blackberry are present in scattered patches throughout the site. Herb Robert was found in three locations at the site. Yellow archangel was observed at the Trout Farm Road river access site; this is the only occurrence of this species in the study area.

4.3.4 Spada Lake Area, including North Shore Road and Recreation Site 8

In the vicinity of the Spada Lake Tract, weeds were inventoried on the Spada Reservoir shoreline, adjacent WHMP lands, Project facilities at Culmback Dam, and the North Shore Road and Recreation Site, both of which are located outside of the tract boundaries. A total of 15 weed species were recorded. The three target weed species that were not observed in this area are butterfly bush, invasive knotweed, and yellow archangel. The USFS species of concern English holly was not recorded in the Spada Basin.

No weeds were observed in the two old-growth units that were surveyed in the Spada Lake Tract. Only three of ten commercially thinned timber units supported weeds; in each case the species observed was evergreen blackberry.

4.3.4.1 Project Recreation Sites 1-5 and Roads

Recreation Site 1 at Olney Pass consists primarily of a cleared parking and visitor use area. Canada thistle, bull thistle, tansy ragwort, and reed canarygrass are present at this site. Project recreation sites 2 through 4 (South Fork, South Shore, and Nighthawk) are located adjacent to the reservoir along the southern shoreline. Disturbed habitats within Site 2 support evergreen blackberry, herb Robert, and reed canarygrass along portions of the shoreline. Site 3 has infestations of both Canada and bull thistle, and Himalayan and evergreen blackberry. Wetland 9-105, located west of Site 3, supports reed canarygrass along the reservoir shoreline, but does not exhibit infestations of other weeds observed at the adjacent recreation site. Nighthawk, Site 4, supports populations of Himalayan blackberry on upland disturbed habitats and reed canarygrass along the shoreline. Site 5, Bear Creek, is the most remote of these five recreation sites, and is located on a bluff above the reservoir. Evergreen blackberry is the only weed that was observed at this site.

Roads accessing the recreation sites were also surveyed for noxious weeds. Between recreation sites 1 and 3, a total of 8 species of weeds were observed, including Canada thistle, bull thistle, herb Robert, reed canarygrass, Himalayan and evergreen blackberry, and tansy ragwort. Spotted knapweed (*Centaurea biebersteinii*) was observed along the South Shore Road a short distance east of Olney Pass; this is the only documented occurrence of the species in the study area. Between recreation sites 3 and 4, Canada thistle, reed canarygrass, evergreen blackberry, and tansy ragwort were observed. The single largest infestation of tansy ragwort in the study area occurs at wetland 9-119 which is adjacent to the South Shore Road between recreation sites 3 and 4. This wetland also exhibits infestations of Canada thistle, bull thistle, and reed canarygrass. From Recreation Site 4 to the eastern end of the Spada Lake Tract, Canada thistle, bull thistle, reed canarygrass, Himalayan blackberry, and evergreen blackberry are present in scattered patches along the South Shore Road.

Other non-native invasives observed at the recreation sites and along the South Shore Road include common St. Johnswort, hairy cat's ear, and oxeye daisy.

4.3.4.2 Spada Reservoir Shoreline

The shoreline of Spada Lake was surveyed along an approximately 25-foot wide strip upslope of the high water line. The associated wetlands 9-73 and 9-95 at the eastern end of the reservoir also were surveyed. The northern shoreline is relatively steep-sloped, with the exception of a few small wetland habitats along larger stream mouths. Scattered individual plants of Canada thistle, Himalayan blackberry, and evergreen blackberry were recorded along this segment; reed canarygrass is present in scattered locations, including the mouths of larger streams.

Along the Williamson Creek Arm, eastward to the North Arm, and along the south shoreline to wetland 9-95, reed canarygrass is present in larger stands where shallowwater habitat exists. Wetland 9-73 has substantial acreage of reed canarygrass extending well into the reservoir below the full pool elevation; the canarygrass is exposed during lower water periods of late summer and fall. Small patches of evergreen blackberry were also observed along this segment of the shoreline.

South Fork and other locations along the south shoreline are more gently sloped than the north shoreline. Several small wetlands and accumulations of woody debris are present and these sites support growth of reed canarygrass. Canada thistle, Himalayan blackberry, and evergreen blackberry also were observed in scattered small infestations along the shoreline.

The southwest reservoir shoreline, including the Culmback Dam vicinity, supports patchy infestations of both Canada and bull thistle, Himalayan and evergreen blackberry, and reed canarygrass.

Other invasive non-natives observed along the reservoir shoreline include common St. Johnswort and hairy cat's ear; both were observed at a small number of sites along the southern and southwestern shorelines.

4.3.4.3 Culmback Dam and Vicinity

At the Culmback Dam site, the list of target weeds was expanded to include the USFS species of concern. Eleven weed species were observed at the dam, including the face of the fill extending down to the river and the terraced slope to the north of the dam. Canada thistle, bull thistle, and wild carrot all were observed at the dam. Scotch broom is present in small numbers; this is the one of only two sites in the Spada Basin where the species was observed. Several infestations of yellow hawkweed were recorded on the terraced slope; and unknown hawkweed was also present on the terraced slope, dam face, base of dam and roadsides. Hairy cat's ear was observed on the terraced slope and roads, but not the face of the dam. Both Himalayan and evergreen blackberry were recorded on the edges of terraces and base of dam, in partially shaded sites. Tansy ragwort was not observed at the dam during the 2007 inventory, although this species has been noted and treated at Culmback Dam in the past.

A segment of road located to the north of the dam, within the WHMP tract, exhibited patchy infestations of bull thistle, herb Robert, reed canarygrass, and Himalayan and evergreen blackberry. The Culmback Dam Road, between the dam and Olney Pass, had several infestations of both Canada and bull thistle, Himalayan and evergreen blackberry, and reed canarygrass. Two small patches of yellow hawkweed were recorded; both of these were located in the eastern portion of the road.

The North Shore Road is currently blocked to vehicle access over a mile from Recreation Site 8, North Shore; the majority of the road is located on DNR lands outside the WHMP tract. Noxious weeds documented along the road include Canada and bull thistle, Himalayan and evergreen blackberry, tansy ragwort, and reed canarygrass. Weeds at the recreation site currently are limited to the cleared overlook area; species observed include herb Robert, Himalayan and evergreen blackberry, and tansy ragwort. Scotch broom was not observed at the North Shore Recreation Site during the 2007 inventory, although this species has been noted at this site in the past.

Other invasive non-native species observed at Recreation Site 8 and the North Shore Road are hairy cat's ear and oxeye daisy; common St. Johnswort was observed along the North Shore Road.

4.3.4.4 6122 Road System

Two segments of road on the 6122 road system were surveyed, where the road is located within or adjacent to the Spada Lake WHMP tract. The lower segment of Forest Road 6122 extends between the Culmback Dam Road and NFS lands to the west; reed canarygrass, Himalayan blackberry and evergreen blackberry were observed. The upper road segment is part of the abandoned 6122110 Road. Evergreen blackberry is the only

target weed species that was recorded along this road segment. Weed occurrences on NFS lands on Forest Road 6122 are discussed in Section 4.3.6.

4.3.5 Williamson Creek Area

Noxious weed surveys in the Williamson Creek area focused on abandoned logging roads within the WHMP boundary and adjacent Spada Lake Tract. Five target weed species were documented: bull thistle, yellow hawkweed, reed canarygrass, Himalayan blackberry, and evergreen blackberry. An unknown invasive hawkweed was also observed growing intermixed with yellow hawkweed; this species was not documented independently. Roads on the west side of Williamson Creek did not show any evidence of hawkweed infestation, while the main road on the east side of the creek supported several infestations, even under the canopy of young regenerating alder occupying the roadbed. The remaining weed species are present intermittently along the abandoned roads. Other non-native species observed during the inventory include common St. Johnswort, hairy cat's ear, and oxeye daisy. Special status plant surveys of old-growth habitat in the Williamson Creek drainage did not detect any target weed species.

4.3.6 NFS Lands

Eleven weed species were documented on or immediately adjacent to NFS lands in the Sultan River bypass reach and along Forest Road 6122. Canada thistle and evergreen blackberry were observed at four of five NFS lands survey sites. Oxeye daisy was present at three sites; hairy cat's ear, and Himalayan blackberry were observed at two of the sites. Six species, bull thistle, Scotch broom, herb Robert, common St. Johnswort, English holly, and reed canarygrass, were observed at one site each.

4.3.6.1 Forest Road 6122

NFS lands on Forest Road 6122 between the Spada Lake Tract boundary and the Sultan River access trail supported seven weed species: Canada thistle, Scotch broom, common St. Johnswort, hairy cat's ear, oxeye daisy, and Himalayan and evergreen blackberry. The weeds were clustered in the two clearings along the road. The eastern clearing is used as a vehicle turnaround; the western clearing is more recent in origin and was formed by a landslide that blocked the road.

4.3.6.2 Forest Road 6122 River Access Trail and Riparian Area

The river access trail from the 6122 road and the riparian zone along the river were surveyed, resulting in observation of two weed species. Evergreen blackberry occurs discontinuously along the access trail; a single plant was found in the riparian zone along the left bank of the river. An infestation of about 20 plants of Canada thistle was observed on the left bank of the river; one additional plant was observed on the opposite shore.

4.3.6.3 Stringer Bridge River Access

Seven weed species were observed at the Stringer Bridge site which included over a mile of abandoned road accessing the river from the north side. Hairy cat's ear is present

along a series of rock outcroppings located about 20 feet above the river bed on the left bank at the upstream end of the riparian zone segment. The population is localized, but consists of between 100-150 plants, many of which are first year rosettes. Along the river shoreline small patches of reed canarygrass and evergreen blackberry were observed. The remaining weed populations, including additional evergreen blackberry, a single English holly, herb Robert, and both Canada and bull thistle, were observed along the access road.

4.3.6.4 Big Four River Access

The Big Four river access consists of a series of miner's trails located on the south side of the Sultan River. The inventory of the trail network and the riparian corridor resulted in detection of four species of weeds: Canada thistle, oxeye daisy, and both Himalayan and evergreen blackberry. All four species were found along the river's edge at points where trails reached the riverbank. Three of the four infestations were limited to one or two plants, which were pulled. The oxeye daisy population is scattered along the river's edge in a narrow band approximately 2,000 feet long.

4.2.6.5 Diversion Dam River Access

Upstream of the Diversion Dam approximately 1000 linear feet of NFS lands were accessible for survey on the left bank of the river. One weed species, oxeye daisy, was observed in this reach, consisting of a small scattered population along the shoreline. Several other weed species were observed downstream of the NFS lands, on co-licensee owned lands; these weed sightings are reported under the Lake Chaplain area results.

4.4 Noxious Weed Distribution by Species

4.4.1 Class B Designate Weeds

4.4.1.1 Spotted Knapweed (Centaurea biebersteinii)

Spotted knapweed was observed at a single site along the South Shore Road in the Spada Lake Tract, a short distance east of Olney Pass. The infestation consisted of a small number of plants which were pulled and removed from the site. Seed may remain in the soil at the site. This species is not typical of the moist forested habitats in the Project area and possibly was transported to the site via road maintenance equipment.

4.4.1.2 Yellow Hawkweed (Hieracium caespitosum)

Yellow hawkweed was observed in 28 locations in the Project area. Infestations were observed in all but two of the geographic areas surveyed, including Lake Chaplain (19), Project Facilities (5), Spada Lake (3), and Williamson Creek (1).

Yellow hawkweed was most commonly observed on disturbed roadsides and areas where vegetation is maintained. In the Lake Chaplain area it was present along the C-1000 and S-1000 roads, the Lake Chaplain shoreline, and the Sultan River at the Diversion Dam. It was also present in shrub habitat near the Powerhouse visitor kiosk, and several recently harvested timber units. At the Project Facilities area, yellow hawkweed was present on

DNR lands near the Powerhouse and along the power pipeline right-of-way. In the Spada Lake area, the species was observed only at the Culmback Dam survey site, where it is present along the dam terraces and along the Culmback Dam Road near Olney Pass. A linear population of yellow hawkweed was observed along the abandoned road adjacent to Williamson Creek.

The species was not detected at Lost Lake or on NFS lands in the bypass reach and along Forest Road 6122.

4.4.1.3 Unknown Hawkweed (Hieracium sp.)

One or more unidentified species of non-native, invasive hawkweed was collected at two documented sites: the Lake Chaplain Road between the Diversion Dam Road and the Filtration Plant, and at Culmback Dam. Unknown species of hawkweed were also observed (but not reported separately from yellow hawkweed) at the power pipeline right-of-way, the Lake Chaplain shoreline, and along Williamson Creek roads. In every case, this species occurred together with readily identifiable *Hieracium caespitosum*; often the native hawkweed *Hieracium albiflorum* was also present on or near the site. Several samples of the collected material have been sent to the University of Idaho for identification.

4.4.2 Weed Species Selected for Control by Snohomish County

4.4.2.1 Canada thistle (Cirsium arvense)

Canada thistle is widely distributed in open, moist habitats in the Project area. The species was recorded in a total of 14 infestations in the Lake Chaplain area, 7 infestations in the Project Facilities area, 20 infestations in the Spada Lake area, and 5 infestations on NFS lands in the Sultan River bypass reach and along Forest Road 6122. It was not recorded in the Lost Lake and Williamson Creek tracts.

Canada thistle was most commonly observed on disturbed roadsides and recreation sites. It was also common on sites with ongoing vegetation maintenance or disturbance, including the power pipeline right-of-way, Powerhouse facilities, Culmback Dam, and both the Lake Chaplain and Spada Lake shorelines. The species was not frequently observed in timber management units, except along spur roads and open areas.

4.4.2.2 Bull Thistle (Cirsium vulgare)

Bull thistle is the third most common weed species in the Project area in terms of number of infestations. Sixty-eight infestations were recorded, including 26 in the Lake Chaplain area, 12 in the Project Facilities area, 25 in the Spada Lake area, 4 in the Williamson Creek area, and 1 on NFS lands in the Sultan River bypass reach. Bull thistle was not recorded at Lost Lake or along its access road.

Habitats supporting bull thistle in the Project area include roads, river access and recreation sites, habitats undergoing regular vegetation maintenance, including Project facilities lands at the Powerhouse, the power pipeline right-of-way, and Culmback Dam.

Unlike Canada thistle, bull thistle was frequently observed in recently harvested timber management units in the Lake Chaplain area.

4.4.2.3 Invasive Knotweed (Polygonum sp.)

Knotweed was documented at a single site, the Old Gaging Station river access located off of Lake Chaplain Road. This infestation has been managed by the City of Everett and was treated in 2007. No above ground plant parts were observed during the survey of the site.

4.4.2.4 Tansy Ragwort (Senecio jacobaea)

Tansy ragwort is currently limited to 21, generally very small, populations in the Project area. Eight infestations were reported in the Lake Chaplain area; six of these consisted of less than ten plants that were pulled and removed. Two additional populations are present along the Lake Chaplain Road and the C-1300 Road. In the Project Facilities area, seven infestations of tansy ragwort were observed at the Powerhouse site and along the power pipeline right-of-way between Horseshoe Bend and the tunnel; plants were pulled at four of the locations. Six infestations were detected in the Spada Lake area, including along the South Shore Road between Recreation sites 1 and 4, at wetland 9-119, along the North Shore Road and at Recreation Site 8. Four of the infestations were small and were treated by pulling the plants. The only substantial tansy ragwort infestation is located at wetland 9-119 and the adjacent South Shore Road. This site has been treated previously by District staff; however, the weed persists at the site.

Tansy ragwort was not reported from the Lost Lake, Williamson Creek, or Sultan River bypass reach areas.

4.4.3 Class B Weeds Undesignated in Snohomish County

4.4.3.1 Scotch Broom (Cytisus scoparius)

Scotch broom was reported from a total of 13 locations in the Project area. Four infestations are located in the Lake Chaplain area, primarily along the SP-1000 Road and the Lake Chaplain Road. Two of the infestations consisted of a single plant which was pulled. The Project Facilities area supports seven infestations, extending from the Powerhouse along the length of the power pipeline right-of-way; one single plant outside the mowed area of the right-of-way was pulled. One infestation is present in the Spada Lake area, along the road near Culmback Dam. Scotch broom is also present on NFS lands along Forest Road 6122.

Most of the Spada Lake area was free of Scotch broom. Neither Lost Lake nor the Williamson Creek area supported this species.

4.4.3.2 Wild Carrot (Daucus carota)

Wild carrot is present in very limited distribution in the Project area, with a total of three infestations recorded during the survey. In the Project Facilities area, four patches are located along the power pipeline right-of-way and scattered individuals are present at the

Powerhouse beneath the transmission line. Scattered plants are present on the terraces above Culmback Dam in the Spada Lake area.

4.4.3.3 Herb Robert (Geranium robertianum)

The majority of the 25 observed herb Robert infestations are located in the Lake Chaplain area (14). Two commercially thinned units, one harvested unit, and a number of river access sites and roads support the species. Herb Robert is also present as a single infestation along the Lost Lake access road; this site was treated by District staff during summer 2007 by hand pulling. Five populations of herb Robert were recorded at the Project Facilities area, at the DNR lands river access site near the Powerhouse, the Trout Farm Road river access, and in the shrub habitat near the Horseshoe Bend visitor kiosk. In the Spada Lake area, four populations were recorded at recreation sites 1 and 8, along the South Shore Road between recreation sites 1 and 3, and along the road north of Culmback Dam. One population was recorded on NFS lands in the Sultan River bypass reach.

Herb Robert was not detected in the Williamson Creek area.

4.4.3.4 Hairy Cat's Ear (Hypochaeris radicata)

Hairy cat's ear is a species of concern to the USFS; this species was included in the formal weed survey only on NFS lands and at the Culmback Dam site. Four infestations were recorded. At Culmback Dam, the species is present on the road and the terraced slopes north of the dam; it was not observed on the face or base of the dam. The species was observed on NFS lands at the Stringer Bridge site and along Forest Road 6122.

Although not formally inventoried, hairy cat's ear was recorded on the species list from every other geographic area. It was commonly observed along roads, recreation sites, river access sites, disturbed and/or managed habitats, and reservoir shorelines.

4.4.3.5 Oxeye Daisy (Leucanthemum vulgare)

Oxeye daisy is a species of concern to the USFS; this species was included in the formal weed survey only on NFS lands and at the Culmback Dam site. One infestation was observed at Culmback Dam, where the species is present at the base of the dam, along the road, and on the terraced slopes north of the dam. Oxeye daisy was also observed within the Sultan River riparian corridor on NFS lands at the Diversion Dam site, Big 4 Creek, and along Forest Road 6122.

Oxeye daisy was not formally inventoried in the other geographic areas, but was recorded on species lists for each area. The species was most commonly observed along roads, recreation and river access sites, and habitats with ongoing vegetation maintenance.

4.4.4 Class C Weeds

4.4.4.1 Butterfly Bush (Buddleja davidii)

Butterfly bush is present in a total of 15 infestations in the Lake Chaplain and Project Facilities areas. Twelve infestations were recorded in the Lake Chaplain area, primarily along Lake Chaplain Road, the SP-1000 Road, and the SP-1300 Road. A few infestations were recorded in and adjacent to harvested units. Three infestations were recorded in the Project Facilities area, two at the Powerhouse site, and one along the power pipeline right-of-way between the Powerhouse and Horseshoe Bend.

Butterfly bush was not observed at Lost Lake, the Sultan River bypass reach, or in the Spada Basin.

4.4.4.2 Common St. Johnswort (Hypericum perforatum)

Common St. Johnswort is a species of concern to the USFS; this species was included in the formal weed survey only on NFS lands and at the Culmback Dam site. The species was documented as a dominant weed on the face and base of dam, terraced slopes north of the dam, and road at the Culmback Dam site. It was also present in two clearings on NFS lands along Forest Road 6122.

Although not formally inventoried, the common St. Johnswort was noted on species lists from every geographic area covered in the survey. It was commonly observed along roads, recreation sites and river access areas, and sites with ongoing vegetation maintenance and disturbance, reservoir shorelines, and recently harvested timber units.

4.4.4.3 Yellow Archangel (Lamiastrum galeobdolon)

Yellow archangel was reported from a single survey site, the Trout Farm Road river access site. This is the lowest elevation site that was included in the survey, and is the closest site to the Town of Sultan. The infestation was less than 0.1 acre in size and was growing in the shade of a mature bigleaf maple tree.

4.4.4.4 Reed Canarygrass (Phalaris arundinacea)

Reed canarygrass is widely distributed in the Project area. The species was recorded in 65 locations, ranging from small populations of a few square feet to more extensive, continuous expanses of several acres. The Lake Chaplain area supported 26 infestations, Lost Lake a single population, the Project Facilities area supported 9 populations, Spada Lake area had 25 infestations, Williamson Creek had 3 populations, and a single population was recorded on NFS lands in the Sultan River bypass reach.

Reed canarygrass was commonly observed along roadside ditches, disturbed moist habitats around Project facilities, scattered to continuous patches along the reservoir shorelines, and in scattered patches in Chaplain Marsh. The species was occasionally observed in small patches in wet areas in recently harvested units. The largest infestations of reed canarygrass occur in wetlands 9-95, 9-105, and 9-73 at the eastern end of Spada Lake. Reed canarygrass is a dominant species in these wetlands.
An isolated patch of reed canarygrass of about 100 square feet in area was documented along the northeastern shore of Lost Lake. The seed heads were removed from this patch by District staff during August 2007.

4.4.5 Weed Species of Concern to the Co-Licensees or USFS

4.4.5.1 English holly (llex aquifolium)

English holly is a species of concern to the USFS; this species was included in the formal weed survey only on NFS lands and at the Culmback Dam site. Only one infestation was recorded during the survey; this was a single sapling located along the access road (abandoned) to the Stringer Bridge.

English holly was recorded on species lists from the Lake Chaplain and Project Facilities areas, where it was frequently observed along roadsides and forested margins of disturbed habitats. Holly was commonly observed in timber management units proposed for harvest by the year 2020 and less frequently noted in recently harvested or commercially thinned units. English holly was not observed at Lost Lake, or in the Spada Lake and Williamson Creek areas.

4.4.5.2 Himalayan Blackberry (Rubus discolor)

Himalayan blackberry is an unregulated weed with an extremely wide distribution in the Project area. A total of 91 infestations were recorded, making this the second most common weed recorded during the survey. Infestations of Himalayan blackberry were documented in each geographic area, including Lake Chaplain area (42), Lost Lake (1), Project Facilities (17), Spada Lake (27), Williamson Creek (2), and NFS lands in the Sultan River bypass reach and Forest Road 6122 (2). On NFS lands, the species was observed at the Big 4 river access (plant pulled) and along Forest Road 6122.

Himalayan blackberry is commonly found in association with evergreen blackberry, but generally favors slightly drier sites. The species was frequently observed at river access and recreation sites, along roadsides, in areas of disturbed and/or managed habitats, and in recently harvested and thinned timber units.

4.4.5.3 Evergreen Blackberry (Rubus laciniatus)

Evergreen blackberry is the most common weed in the Project area, based on numbers of infestations recorded during the survey. One hundred and twenty-seven infestations were recorded in total, including 62 in the Lake Chaplain area. The only survey sites in the Lake Chaplain area that did not support evergreen blackberry were four units proposed for harvest by the year 2020. The remaining infestations were located at Lost Lake (3), Project Facilities area (14), Spada Lake area (36), Williamson Creek (6), and NFS lands in the Sultan River bypass reach and Forest Road 6122 (6).

A single infestation along the northeastern shore of Lost Lake was removed by District staff in August 2007. Other infestations in the Lost Lake area occur along the access road. Infestations on NFS lands were noted at Big 4 river access (plant pulled), the

Stringer Bridge access (2 infestations pulled), and Forest Road 6122 (3 infestations, 1 removed).

Habitats favored by evergreen blackberry include river access and recreation sites, roadsides, reservoir shorelines, river access trails, sites subject to ongoing vegetation maintenance, and recently harvested and thinned units.

5.0 DISCUSSION AND CONCLUSIONS

5.1 Regulated Noxious Weeds

5.1.1 Class A and Class B Designate Species

No Class A weed species, for which eradication is required by law, were documented in the weed inventory area. Three Class B Designate species, spotted knapweed, yellow hawkweed, and unknown hawkweed, were reported. Spotted knapweed was limited to a single, very small population that likely was introduced to the site by vehicles or road maintenance equipment. The plants were removed during the survey and the site will continue to be monitored by District staff to ensure that new seedlings do not become established.

The hawkweed species were widely distributed across the Project area, and were associated with disturbed, open habitats of roadsides, Project facilities, maintained shrub/grass habitats, reservoir margins, and recently harvested units. Many of the roadside populations were in areas that are currently mowed; these plants did not have flowering heads or seeds, and were prevented from reproducing by seed. However, invasive hawkweeds are known for their ability to reproduce vegetatively by runners. Repeated mowing does not kill the plants and they can become dominants in these disturbed habitats.

One or more species of invasive hawkweeds that was not identifiable to species was present; the unidentified species occurred in association with yellow hawkweed and often was near populations of native white hawkweed. Invasive hawkweeds are known to exhibit great phenotypic variability and also are known to hybridize readily with other members of the genus (pers. comm. L. Wilson, University of Idaho, Moscow, ID). Some of these species are also able to produce seed without fertilization. These species are not only able to survive and reproduce on harsh sites, but they are capable of outcompeting other species and dominating the sites.

Hawkweed populations at the Project facilities and along Project roads are under ongoing management by the District and City of Everett to prevent their spread.

5.1.2 Species Selected for Control by Snohomish County

Four noxious weed species for which control is currently required by Snohomish County were observed. Although frequently observed, neither Canada thistle nor bull thistle was present in large, dense infestations. Most of the sites supported relatively small numbers of plants. Thistle populations are currently managed by District and City staff at Project facilities and along selected Project roads.

Tansy ragwort was observed at a moderate number of sites, typically in infestations consisting of only a one to a few plants, many of which were treated during the survey. District and City staff manage tansy ragwort populations at Project facilities and along Project roads. One site, wetland 9-119 and the adjacent South Shore Road, has a well-established and potentially expanding population of tansy ragwort. Tansy ragwort at this site has been hand-pulled by District staff for several years and will continue to be managed.

Invasive knotweed is limited to a single site in the Project area, which was treated by the City of Everett during 2007. Knotweed is abundant and spreading northward along the Sultan Basin Road in the vicinity of the 116th Street SE access to the Powerhouse site. It is also known from DNR lands north of Lake Chaplain. Introduction of knotweed to the Project area could occur through transfer of seed and/or vegetative material, particularly by road maintenance and mowing equipment. District and City biologists are aware of this threat and actively observe for new occurrences of knotweed on or adjacent to Project lands.

5.1.3 USFS Species of Concern

Weed infestations on NFS lands in the bypass reach of the Sultan River are generally very small populations of one to a few individuals. Most of the weed infestations are along the immediate riparian zone and access trails, in areas where human access occurs for mining and/or recreational use. One exception to this pattern of distribution is a moderately large population of hairy cat's ear that was observed at the Stringer Bridge survey site, on rock ledges about 20 feet above the river. The population consisted of over 100 individuals, most of which were still in the rosette (non-flowering) phase. The seed heads were removed from flowering plants at this site, but the population may continue to expand.

The largest weed populations on NFS lands occurred in the two clearings on Forest Road 6122. The lower elevation clearing is used as a vehicle turn-around; the upper clearing was created by a relatively recent landslide. Both sites support several weed species whose populations are becoming well-established.

5.2 Non-Regulated Weed Species

The majority of weed species observed during the inventory are non-regulated. The colicensees are currently managing several of these species on Project lands based on sitespecific parameters. However, management of all of these species, particularly those that are very widespread, such as evergreen blackberry, Himalayan blackberry, and reed canarygrass, is likely impractical.

Certain species of non-regulated weeds occur in small numbers in the inventory area and could be readily controlled or eradicated. For example, yellow archangel, located at the

Trout Farm Road river access site, is a relatively small and isolated infestation and could likely be controlled with one or two treatments. For other weed species, control would require repeated action over larger areas and longer periods of time. For example, butterfly bush may be readily cut back; however, the cut stumps tend to sprout aggressively and would require repeat treatments. Also, seed that has accumulated in the soil near mature plants will sprout for several years, necessitating additional follow-up treatments.

5.3 Weed Management on the Jackson Project

The co-licensees implement an ongoing program of noxious weed management at the Jackson Project. In 1986, the District adopted a policy that directed its mangers to 'establish a safe, economical and environmentally responsible Vegetation Management Program (VMP) that utilizes an integrated pest management approach with minimal negative impacts to the environment and human health.' The program has been updated over the years, most recently in 2004. With regard to the Jackson Project, the program calls for minimal herbicide use in the Project area for the protection of water quality and other environmental resources. The program allows for application of approved herbicides where other methods (*e.g.*, hand-pulling, clipping, mowing) have proven to be ineffective or are unlikely to succeed.

While control levels of regulated weed species are determined by the state, county, or other weed management authority, the determination of acceptable levels of non-regulated weeds is typically made through evaluation of site-specific parameters. Integrated pest management (IPM) principles are applied in the analysis, which takes into account the risk posed by the weed species, the value of the habitats affected, and the costs and risks- both environmental and economic- of the available treatment methods. The results of this weed inventory in combination with the co-licensees annual records of monitoring and treatment at the Project, provide the information necessary for the co-licensees to review and update their current Vegetation Management Program with regard to both regulated and non-regulated weed species.

5.3.1 Prevention of Introduction and Spread of Weeds

In general, weeds in the inventory area occur within habitats that are disturbed by human activities: roadsides, human-maintained shrub and grass habitats at Project facilities, timber management units that have been commercially thinned and harvested, and recreation and river access sites. Habitats disturbed by fluctuating water levels at the Lake Chaplain and Spada Lake reservoirs show moderate numbers of weed species and infestations. Riparian habitats along the Sultan River bypass reach show relatively low numbers of weed species and infestations. Many of the weed infestations within timber units appear to have been introduced by equipment and vehicles used during the harvest activity, as evidenced by the close proximity of infestation of a given species on spur roads to established infestations on adjacent mainline roads.

One tool available to the co-licensees to reduce the potential for future introduction and spread of weeds on Project lands is a set of best management practices for soil

disturbance, vegetation maintenance, and other habitat disturbing activities. Best management practices (BMPs) could include actions such as treating infestations prior to ground disturbance, to reduce mechanical dispersal of propagules. Cleaning of vehicles and equipment is another effective method to reduce transfer of propagules from one locale to another. In areas infested by weeds, even the act of parking a truck to survey for the weeds can lead to new infestations, if weed seeds are transported by the tires or undercarriage of the vehicle. Mowing equipment, road grading and maintenance equipment, and other facility vehicles and equipment could be addressed through a vehicle-cleaning BMP. Standards for import of soil, road fill material, seed, mulch, and other materials used as part of road, recreation site, or Project facility maintenance, would also contribute to reduced rates of weed propagule introduction to the Project area.

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Figure 4-1. Sites Surveyed for Noxious Weeds (Map 1 of 6)



Figure 4-1. Sites Surveyed for Noxious Weeds (Map 2 of 6)



Figure 4-1. Sites Surveyed for Noxious Weeds (Map 3 of 6)



Figure 4-1. Sites Surveyed for Noxious Weeds (Map 4 of 6)





Figure 4-1. Sites Surveyed for Noxious Weeds (Map 6 of 6)



Figure 4-2. Noxious Weed Locations (Map 1 of 6)



Figure 4-2. Noxious Weed Locations (Map 2 of 6)



Figure 4-2. Noxious Weed Locations (Map 3 of 6)



Figure 4-2. Noxious Weed Locations (Map 4 of 6)



Figure 4-2. Noxious Weed Locations (Map 5 of 6)



Figure 4-2. Noxious Weed Locations (Map 6 of 6)

Appendix A

Noxious Weed List

Appendix A 2007 Washington State Noxious Weed List with Snohomish County Designations and USFS and Jackson Project Species of Concern

Common Name	Scientific Name	Code
Class A		•
velvetleaf	Abutilon theophrasti	ABTH
garlic mustard	Alliaria petiolata	ALPE4
thistle: Italian	Carduus pycnocephalus	CAPY2
slenderflower	Carduus tenuiflorus	CATE2
purple starthistle	Centaurea calcitrapa	CECA2
knapweed: bighead	Centaurea macrocephala	CEMA9
knapweed: Vochin	Centaurea nigrescens	CENI3
common crupina	Crupina vulgaris	CRVU2
spurge: eggleaf	Euphorbia oblongata	EUOB4
goatsrue	Galega officinalis	GAOF
reed sweetgrass	Glyceria maxima	GLMA3
Texas blueweed	Helianthus ciliaris	HECI
giant hogweed	Heracleum mantegazzianum	HEMA17
hawkweed: yellow devil	Hieracium floribundum	HIFL3
hydrilla	Hydrilla verticillata	HYVE3
dyers woad	Isatis tinctoria	ISTI
floating primrose-willow	Ludwigia peploides	LUPE5
wild four o'clock	Mirabilis nyctaginea	MINY
kudzu	Pueraria montana var. lobata	PUMOL
sage: Mediterranean	Salvia aethiopis	SAAE
sage: meadow clary	Salvia pratensis	SAPR2
sage: clary	Salvia sclarea	SASC2
thistle: milk	Silybum marianum	SIMA3
silverleaf nightshade	Solanum elaeagnifolium	SOEL
buffalobur	Solanum rostratum	SORO
lawnweed	Soliva sessilis	SOSE2
johnsongrass	Sorghum halepense	SOHA
cordgrass: dense flower	Spartina densiflora	SPDE2
cordgrass: salt meadow	Spartina patens	SPPA
Spanish broom	Spartium junceum	SPJU2
spurge flax	Thymelaea passerina	THPA7
Syrian bean-caper	Zygophyllum fabago	ZYFA
Class B		
Russian knapweed	Acroptilon repens	ACRE3
camelthorn	Alhagi maurorum	ALMA12
blackgrass	Alopecurus myosuroides	ALMY
indigobush	Amorpha fruticosa	AMFR
bugloss: annual	Anchusa arvensis	ANAR16
bugloss: common	Anchusa officinalis	ANOF
wild chervil	Anthriscus sylvestris	ANSY
hoary alyssum	Berteroa incana	BEIN2
white bryony	Bryonia alba	BRAL4
fanwort	Cabomba caroliniana	CACA
thistle: plumeless	Carduus acanthoides	CAAC
thistle: musk	Carduus nutans	CANU4
longspine sandbur	Cenchrus longispinus	CELO3

Common Name	Scientific Name	Code
knapweed: diffuse	Centaurea diffusa	CEDI3
knapweed; brown	Centaurea jacea	CEJA
knapweed: meadow	Centaurea jacea x nigra	CEJAN
knapweed: black	Centaurea nigra	CENI2
yellow starthistle	Centaurea solstitialis	CESO3
knapweed: spotted	Centaurea stoebe (C. biebersteinii)	CESTM
		(CEBI2)
rush skeletonweed	Chondrilla juncea	CHJU
houndstongue	Cynoglossum officinale	CYOF
yellow nutsedge	Cyperus esculentus	CYES
Scotch broom	Cytisus scoparius	CYSC4
spurge laurel	Daphne laureola	DALA11
wild carrot	Daucus carota	DACA6
blueweed	Echium vulgare	ECVU
Brazilian elodea	Egeria densa	EGDE
spurge: leafy	Euphorbia esula	EUES
spurge: myrtle	Euphorbia myrsinites	EUMY2
common fennel	Foeniculum vulgare	FOVU
herb-Robert	Geranium robertianum	GERO
hawkweed: polar	Hieracium atratum	HIAT2
hawkweed: orange	Hieracium aurantiacum	HIAU
hawkweed: yellow	Hieracium caespitosum	HICA10
hawkweed: queen-devil	Hieracium glomeratum	HIGL3
hawkweed: smooth	Hieracium laevigatum	HILA4
hawkweed: mouseear	Hieracium pilosella	HIPI
common catsear	Hypochaeris radicata	HYRA3
policeman's helmet	Impatiens glandulifera	IMGL
kochia	Kochia scoparia (Bassia scoparia)	KOSC
		(BASC5)
perennial pepperweed		LELA2
lepyrodiclis	Lepyrodiciis holosteoides	LEHO7
oxeye daisy	Leucantnemum vulgare	
Daimatian toadflax	Linaria daimatica ssp. daimatica	
water primrose	Ludwigia nexapetaia (L. grandifiora)	
loosostrifo; gardon	Lusimochia vulgoria	
loosestrife: wand	Lythrum viraatum	
norretfeather	Lytinum vigatum Myriophyllum oquotioum	
Eurosian watermilfoil ¹	Myriophyllum spicatum	MVSP2
vellow floating beart	Nymphoides peltata	
thistle: Scotch	Opopordum acanthium	
hawkweed oxtongue	Picris hieracioides	PIHI
knotweed: Bohemian ¹	Polyaonum bohemicum	POBO10
knotweed: Japanese ¹	Polygonum cuspidatum	POCU6
knotweed: Himalayan ¹	Polygonum polystachyum	POPO5
knotweed: giant ¹	Polygonum sachalinense	POSA4
knotweed: unid invasive spp ¹	Polygonum sp	POINV
sulfur cinquefoil	Potentilla recta	PORE5
Austrian fieldcress	Rorippa austriaca	ROAU
grass-leaved arrowhead	Sagittaria graminea	SAGR
tansv ragwort ¹	Senecio iacobaea	SEJA
perennial sowthistle	Sonchus arvensis ssp. arvensis	SOARA2
cordgrass: smooth	Spartina alterniflora	SPAL
cordgrass: common ¹	Spartina anglica	SPAN5
swainsonpea	Sphaerophysa salsula	SPSA3

Common Name	Scientific Name	Code
saltcedar	Tamarix ramosissima	TARA
hedgeparsley	Torilis arvensis	TOAR
puncturevine	Tribulus terrestris	TRTE
gorse ¹	Ulex europaeus	ULEU
Class C		
jointed goatgrass	Aegilops cylindrica	AECY
absinth wormwood	Artemisia absinthium	ARAB3
butterfly bush	Buddleja davidii	BUDA2
hoary cress	Cardaria draba	CADR
hairy whitetop	Cardaria pubescens	CAPU6
thistle: Canada ²	Cirsium arvense	CIAR4
thistle: bull ²	Cirsium vulgare	CIVU
old man's beard	Clematis vitalba	CLVI6
poison-hemlock ²	Conium maculatum	COMA2
field bindweed	Convolvulus arvensis	COAR4
smoothseed alfalfa dodder	Cuscata approximata	CUAP2
hairy willow-herb ³	Epilobium hirsutum	EPHI
babysbreath	Gypsophila paniculata	GYPA
English ivy: four cultivars only	Hedera helix 'Baltica', 'Pittsburgh', 'Star'	HEHE,
	;H. hibernica 'Hibernica'	HEHI12
spikeweed	Hemizonia pungens	HEPU5
Hawkweeds ² , except not listed	Hieracium spp.	HISPP
as A or B, native spp.		
black henbane	Hyoscyamus niger	HYNI
common St. Johnswort	Hypericum perforatum	HYPE
yellow flag iris	Iris pseudacorus	IRPS
yellow archangel ³	Lamiastrum galeobdolon	LAGA2
yellow toadflax	Linaria vulgaris	LIVU2
scentless mayweed	Matricaria perforata	MAPE2
fragrant water lily	Nymphaea odorata	NYOD
reed canarygrass	Phalaris arundinacea	PHAR3
common reed (nonnative	Phragmites australis	PHAU7
genotypes)		-
curly-leaf pondweed	Potamogeton crispus	POCR3
cereal rye	Secale cereale	SECE
common groundsel	Senecio vulgaris	SEVU
white cockle	Silene latifolia ssp. alba	SILAA3
common tansy	Tanacetum vulgare	TAVU
spiny cocklebur	Xanthium spinosum	XASP2
Species of Concern		
English holly⁴	llex aquifolium	ILAQ80
elephant ear⁴	Petasites japonicus	PEJA3
Himalayan blackberry ⁵	Rubus discolor	RUDI2
evergreen blackberry ⁵	Rubus laciniatus	RULA

Species in **bold** are Snohomish County Class B-designates; **control is required**

¹ Snohomish County Class B Selected; control is required
² Snohomish County Class C Selected; control is required
³ Snohomish County species of concern (not designated or selected)
⁴ USFS species of concern on NFS lands
⁵ Jackson Project species of concern (no specific management required)

Class A Weeds: Non-native species whose distribution in Washington is still limited. Preventing new infestations and eradicating existing infestations are the highest priority. **Eradication of all Class A plants is required by law**.

Class B Weeds: Non-native species presently limited to portions of the State. Species are designated for control in regions where they are not yet widespread. Preventing new infestations in these areas is a high priority. In regions where a Class B species is already abundant, control is decided at the local level, with containment as the primary goal.

Class C Weeds: Noxious weeds which are already widespread in Washington or are of special interest to the state's agricultural industry. The Class C status allows counties to enforce control if locally desired. Other counties may choose to provide education or technical consultation.

Appendix B

Noxious Weed Field Forms

Mt. Baker-Snoqualmie National Forest Invasive Plant Inventory Form Adapted from NRIS TERRA Forms 30 June 2006 tf

Fill out one form for each weed, and attach a ma	ap to each form. Site II	D must be unique for each form.
*Site ID:		Sample Type: INPA
*Descriptive Site Name:		Project Purpose: NW
*Project Name and Mgt Code:		
*Date (MM/DD/YYYY):		
*Primary Examiner (Last, First, Middle Initial):		
*Region 06, Forest 05, District (Circle)	01 Mt. Baker 02 Darrington	05 Snoqualmie 06 Skykomish
WA State *County (Circle)	073 Whatcom 057 Skagit 061 Snohomish	053 Pierce 007 Chelan 037 Kittitas
USGS 7.5' Quad Name	033 King	Quad #
Watershed Name and HUC code		*Ownership
Watershed Analysis Completed? (Circle Yes/No	b) If yes, date complete	d:
Managed Area(s)		
*Local Description of Delugan Contag. T	D C	1/4 of 1/4 Willowette Meridian
*Legar Description of Polygon Center_1	K S	_1/4 or1/4 withamette Meridian
<u>*UTMs of Polygon Center</u>	Must use Geodetic D	atum NAD 83 CONUS
Circle one: GPS GIS easting northing		Zone 10
GPS Model	Error	
Aspect (deg) OR ALL	Avera	age Slope (%)
Elevation (ft) min	_ max OR	average
Circle *Dominant Life Form AL Algae FB Forb GR Graminoid 3 Dominants PLANTS Code	LC Lichen NP Nonvascular plant SH Woody shrub Scientific Name.	SS Subshrub TR Tree
Plant Association	_ Plant Assn Code	Seral Stage

Site Location Comments (Directions, description, aerial photo # and aerial photo date, etc)_____

*Weed PLANTS Code *Weed Scientific Name Circle one each for phenology, life form, and distribution of the weed. Phenology Grasses Forbs and Shrubs Leaves Partially Developed, no heads G1 F1 Vegetative, rosette, pre-flowering Inflorescence inside the sheath G2 F2 Flowering Inflorescence partially or fully extended G3 F3 Fruiting G4 Seeds maturing or mature F4 Senescent or dormant Senescent or dormant G5 Regrowth RG Life Form NP AL Algae Nonvascular plant Woody shrub FB Forb SH FU Fungus SS Subshrub Graminoid GR TR Tree Lichen LC UN Unknown Woody liana VI LI Herbaceous vine Distribution CL SE Clumpy Scattered even Scattered patchy Linear _____ SP LI *Infested Area (acres) _____ Gross area (ac) _____

Infested area is REQUIRED. Minimum size is 0.1 acre. Use Gross Area ONLY when portions of polygon are uninfested. Minimum Gross Area ≥ 1 acre.

Gross Area x % of land occupied by weeds = Infested Area.

*Weed Canopy Cover of Infested Area				
Dauber	nmire Cover Class		OR	Estimated percent cover
T 1 2 3	0 - 1% 1.1 - 5.0 % 5.1 - 25% 25.1 - 50.0%	4 5 6	50.1 - 75.0% 75.1 - 95.0% 95.1 - 100%	

* Horizontal Distance to Water (ft): > 300 feet or if \leq 300 feet; estimated distance:

Vertical Distance to W	Vater (ft)		
Associated Species	PLANTS Code	Scientific Name	
-			
Comments:			
	_		

Current or Proposed Treatment:_____

Directions for the Mt. Baker-Snoqualmie NF Invasive Plant Inventory Form.

Adapted from TERRA Rangeland General Form and Invasives Plant Field Form Protocols. 2 March 2, 2005 lp

Fill out one form for each species. Required fields for NRIS are marked above and below with an asterisk. *

***Site ID.** Must be unique for each form. Format is Ranger District number, examiner initials, weed site number. Example: 02-AR-001 = Darrington RD, Ann Risvold, her first site for that district.

***Descriptive Site Name.** A name someone from general public could recognize, usually associated with a geographic location in the immediate vicinity. Example: Conn Creek Road 2435 (if road, put road name then road number).

***Project.** If sighting is associated with a project, put project name and management code here; skip if sighting is incidental.

*Date. Date of invasive plant sighting, using MM/DD/YYYY format. 05/22/2002.

*Primary examiner. Enter as last name, first name, middle initial.

*District. Circle the appropriate ranger district code.

***County.** Circle the appropriate county and code.

USGS 7.5' Quad Name and Code. Enter the quad name and code. Ex. Skykomish, F347121.

Watershed Name and HUC code. Fifth field watershed name. Enter the watershed hydrologic unit code. Required in NRIS for aquatic invasive plants only; optional for terrestrial and riparian invasive plants.

Watershed Analysis Completed? Complete in office, for future NEPA. Circle Yes or No. If Yes, put date.

Ownership. Enter an appropriate code from the list below.

L .	11 1
BLM	Bureau of Land Management
CGOV	County government
DOD	Department of Defense
F&G	State fish and game
MGOV	Municipal government
NPS	National Park Service
PRIV	Private
OTH	Other
TNC	The Nature Conservancy
TRIB	Tribal
UNIV	University
USFSWS	U.S. Fish and Wildlife Service
USFS	U.S. Forest Service
USOT	U.S. other federal lands

Managed Area(s). Enter any management area names, such as wildernesses, research natural areas, ski areas, administrative sites, or other managed sites.

*Legal Description of Polygon Center. Enter the township, range, section, ¹/₄ ¹/₄ section, and ¹/₄ section of the center of the mapped polygon.

***UTMs of Polygon Center.** Enter the UTM easting and northing of the center of the mapped polygon. Circle GPS or GIS to document how UTMs were obtained. Give GPS model and estimated error for all GPS readings. PLGRs can give error estimate in Figure of Merit (FOM) or feet; other models use distance in feet. Ex. PLGR FOM1; Garmin GPS 12, EPE 23 ft.

Aspect. Enter the average aspect as degrees, OR enter ALL for sites with multiple aspects.

Average Slope. Enter the average slope as percent.

Elevation. Enter the minimum and maximum elevation in feet, OR enter the average elevation for small infestations.

***Dominant Life Form.** Circle the dominant life form at the site.

Dominant Species. Enter the NRCS PLANTS code and full scientific names of the dominant vegetation at the site, 3 species maximum. PLANTS database is available on the web at http://plants.usda.gov/.

Plant Association and Code. Enter the abbreviated plant association name and code from MBS field guide (Henderson, J., R. Lesher, D. Peter, and D. Shaw. 1992. Field guide to the forested plant associations of the Mt. Baker-Snoqualmie NF. USDA Forest Service. Technical Paper R6-ECOL-TP-028-91) Ex. TSHE/GASH-BENE. CHS135.

Enter seral stage.	EM	Early midseral
	ES	Early seral
	LM	Late midseral
	LS	Late seral
	MS	Midseral
	Enter seral stage.	Enter seral stage. EM ES LM LS MS

Priority Rank. Score the importance of treating this site according to the form in K/Botany/Forms/weed_rank_criteria.doc

Polygon Number. Polygon attribute number assigned in ArcGIS.

Site Location Comments. Give directions to site and a general site description. Include aerial photo numbers and dates here.

***Weed PLANTS code.** Give the NRCS plants code of the weed. Ex. POCU6. PLANTS database is available on the web at http://plants.usda.gov/.

*Scientific Name. Give the full scientific name of the species. Ex. Polygonum cuspidatum.

Phenology, life form, and distribution. Circle the appropriate choice for the invasive species.

*Infested Area. Enter the area in acres that is infested by the single invasive species above. Minimum area is 0.1 acre.

Gross Area. Enter the area in acres of a mapped area that contains both infested and uninfested acres. Minimum gross area is 1 acre.

*Weed Canopy Cover. Circle the Daubenmire Cover Class of the single weed species in the infested area OR enter the estimated percent cover of the weed in the infested area.

Horizontal Distance to Water. Circle (> 300') if it is more than 300' to water. If \leq 300' to water, estimate the actual distance in feet.

Vertical Distance to Water. Enter the estimated vertical distance water in feet.

Associated Species. Enter a maximum of 3 species that appear to be directly associated with the invasive species. Use the NRCS plants code and the scientific name of each.

Comments. Give general description of weed occurrence, presence/absence of biocontrols, special management concerns, etc.

Current or Proposed Treatment. In office for future NEPA. Describe treatment history here, or if future treatment is proposed, write prescription here.

Jackson Project Noxious Weed Inventory Daily Summary Form

Date (MM/DD/YYYY):	Surveyo	or:			
Site Name:			Visit no:		
List sighting forms attached by Site ID and	Species	Code: (<i>e.g.</i> KWS003 -	CIVU)		
	_ ·				
	_ ·				
	_ ·				
	_ ·				
	- ·				
	_ ·				
Total number sighting forms for this visit: _		Site survey	complete?	Y	N

Jackson Project Weed Sighting Form

Fill out one form for each weed population recorded and attach a map to form. Site ID: Surveyor's initials and site no. , cumulative over entire inventory

Site ID (ABC###):			Date (mm/dd/yyyy):		
Observer Initials:			Weed Code:		
Site Name:			Weed Name:		
USGS Quad Name:		-	Ownership:		
UTMs: Easting:		-	T/R/S and 1/4 1/4:		
Northina:		-	T/R/S and 1/4 1/4:		
GPS Unit:		-	T/R/S and 1/4 1/4:		
GPS Accuracy:			Geodetic Datum NA	D 27 CONUS	
GPS Location:	center of polygon; start / end of	linear	population; other:		
Size of Affected Area (po	lygon):ft xft	=	ft ²	(or)	_acres
Distribution of wood	1 - single/small clump		Estimated	$T_{raco} = 0.19$	
within affected area				11200 = 0.1%	
	2 = scattered patches		canopy cover of	L0w = 1-25%	
(circle one).	3 = deminent acyor		area (airela ana):	Wi00 = 25-30%	
			alea (clicle olle).	High = 50-75%	1009/
	5 = IIIeai			very high = 75-	100 /6
Average Slope (%):					
Distance to water (wetlan	ds, streams, open water; slope dist	tance ir	n feet):		
Cover type(s) within affect	ted area:				
Sensitive habitats immed	iately adj. to infestation (circle all th Old-growth, mature forest, wetland	at apply ds, ripa	y; list others) rian; other:		
Associated species (list u	p to three dominants in each categ	ory; list	noxious weeds separ	ately):	
Trees:					
Shrubs:					
Herbaceous:					
Noxious weeds:					
Notes on apparent weed vector	s:(dispersed camping, trails, ORV/mt. bikeu	ise, pack	trails, roads, waterbodies, o	other)	
Directions to site:					
Comments (note if individ	lual plants were pulled, dug):				
		. <u></u> .			

Appendix C

Species List

Appendix C

Species List Study 7 Special Status Plants and Study 8 Noxious Weeds

Species Code	Scientific Name	Common Name
Trees		
ABAM	Abies amabilis	silver fir
ABGR	Abies grandis	grand fir
ACMA	Acer macrophyllum	bigleaf maple
ALRU	Alnus rubra	red alder
CONU4	Cornus nutallii	Pacific dogwood
ILAQ80	llex aquifolia	holly
PISI	Picea sitchensis	Sitka spruce
POBAT	Populus balsamifera ssp. trichocarpa.	black cottonwood
POTR5	Populus tremuloides	aspen
PREM	Prunus emarginata	bitter cherry
PSME	Pseudotsuga menziesii	Douglas fir
RHPU	Rhamnus purshiana	cascara
ROBINIA	Robinia sp.	locust
TABR2	Taxus brevifolia	western yew
THPL	Thuja plicata	western red cedar
TSHE	Tsuga heterophylla	western hemlock
Shrubs		
ACCI	Acer circinatum	vine maple
ACGLD4	Acer glabrum var. douglasii	Douglas maple
AMAL2	Amelanchier alnifolia	serviceberry
BUDA2	Buddleja davidii	butterfly bush
CLPY3	Cladothamnus pyroliflorus	copperbush
COSE16	Cornus sericea	red osier dogwood
COCO6	Corylus cornuta	beaked hazlenut
CRDO2	Crataegus douglasii	black hawthorn

Species Code	Scientific Name	Common Name
CYSC4	Cytisus scoparius	Scotch broom
GASH	Gaultheria shallon	salal
HODI	Holodiscus discolor	oceanspray
КАРО	Kalmia polifolia	western bog laurel
LEGR	Ledum groenlandicum	Labrador tea
LIBO3	Linnaea borealis	twinflower
LOCI3	Lonicera ciliosa	orange honeysuckle
LOIN5	Lonicera involucrata	black twinberry
LUHY	Luina hypoleuca	silverback luina
MAAQ2	Mahonia aquifolium	tall Oregon grape
MANE2	Mahonia nervosa	dull Oregon grape
MEFE	Menziesia ferruginea	fool's huckleberry
OECE	Oemleria cerasiformis	Indian plum
OPHO	Oplopanax horridus	devil's club
PAMY	Pachystima myrsinites	mountain boxwood
PHCA11	Physocarpus capitatus	Pacific ninebark
RILA	Ribes lacustre	black gooseberry
RISA	Ribes sanguineum	red flowering currant
RIBR	Ribes bracteosum	stink currant
RIVI3	Ribes viscosissimum	sticky currant
ROGY	Rosa gymnocarpa	baldhip rose
ROPI2	Rosa pisocarpa	clustered wild rose
ROSA	Rosa sp.	rose
RONU	Rosa nutkana	Nootka rose
RUDI2	Rubus discolor	Himalayan blackberry
RULA	Rubus laciniatus	evergreen blackberry
RULA2	Rubus lasiococcus	dwarf bramble
RULE	Rubus leucodermis	black raspberry
RUPA	Rubus parviflorus	thimbleberry
RUPE	Rubus pedatus	five-leaved bramble
RUSP	Rubus spectabilis	salmonberry

2

Species Code	Scientific Name	Common Name	
RUUR	Rubus ursinus	trailing blackberry	
SALUL	Salix lucida ssp. lasiandra	Pacific willow	
SASC	Salix scouleriana	Scouler's willow	
SASI2	Salix sitchensis	Sitka willow	
SALIX	Salix sp.	willow	
SARA2	Sambucus racemosa	red elderberry	
SOAU	Sorbus aucuparia	Rowan tree	
SOSI2	Sorbus sitchensis	Sitka mountain ash	
SORBUS	Sorbus sp.	mountain ash	
SPDOD	Spiraea douglasii ssp. douglasii	spirea	
SYAL	Symphoricarpos albus	snowberry	
VIED	Viburnum edule	highbush cranberry	
VAOV	Vaccinium ovalifolium	oval-leaf huckleberry	
VAOV2	Vaccinium ovatum	evergreen huckleberry	
VAOX	Vaccinium oxycoccos	bog cranberry	
VAPA	Vaccinium parvifolium	red huckleberry	
Ferns, clubmosses, hor	setails		
ADPE	Adiantum pedatum	maidenhair fern	
ASTR2	Asplenium trichomanes	maidenhair spleenwort	
ATFI	Athyrium felix-femina	lady fern	
BLSP	Blechnum spicant	deer fern	
CYFR2	Cystopteris fragilis	fragile fern	
DREX2	Dryopteris expansa	spreading wood fern	
EQAR	Equisetum arvense	common horsetail	
EQFL	Equisetum fluviatile	swamp horsetail	
EQHY	Equisetum hyemale	scouring rush	
EQUISETUM	Equisetum sp.	horsetail	
GYDR	Gymnocarpium dryopteris	oak fern	
LYAN2	Lycopodium annotinum	stiff clubmoss	
LYCL	Lycopodium clavatum	running clubmoss	
LYSE	Lycopodium selago	fir clubmoss	
LYCOPODIUM	Lycopodium sp.	clubmoss	

Species Code	Scientific Name	Common Name		
POGL8	Polypodium glycyrrhiza	licorice fern		
POMU	Polystichum munitum	swordfern		
ΡΤΑΟ	Pteridium aquilinum	bracken fern		
SEOR	Selaginella oregana	Oregon selaginella		
Grasses, rushes, sedges				
AGALP	Agrostis alba var. palustris	creeping bentgrass		
AGEX	Agrostis exarata	spike bentgrass		
AGID	Agrostis idahoensis	Idaho bentgrass		
AGOR	Agrostis oregonensis	Oregon bentgrass		
AGROSTIS	Agrostis sp.	bentgrass		
AICA	Aira caryophyllea	silver hairgrass		
ANOD	Anthoxanthum odoratum	sweet vernalgrass		
BRSI	Bromus sitchensis	Sitka brome		
BRVU	Bromus vulgaris	Columbia brome		
CACA4	Calamagrostis canadensis	bluejoint		
CACA11	Carex canescens	silvery sedge		
CACU5	Carex cusickii	Cusick's sedge		
CADE9	Carex deweyana	Dewey's sedge		
CAEC	Carex echinata	Star sedge		
CAHE7	Carex hendersonii	Henderson's sedge		
CALE8	Carex lenticularis	lenticular sedge		
CALE10	Carex leptalea	bristle-stalked sedge		
CALI6	Carex limnophila	Mackenzie smallwing sedge		
CAME6	Carex mertensii	Merten's sedge		
CAOB3	Carex obnupta	slough sedge		
CASI3	Carex sitchensis	Sitka sedge		
CAREX	Carex sp.	sedge		
CAST5	Carex stipata	sawbeak sedge		
CAVE6	Carex vesicaria	inflated sedge		
CARE4	Carex retrorsa	retrorse sedge		
DAGL	Dactylis glomerata	orchard grass		

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Species Code	Scientific Name	Common Name
DUAR3	Dulichium arundinaceum	threeway sedge
ELPA3	Eleocharis palustris	common spikerush
ELGL	Elymus glaucus	blue wildrye
ELGLB	Elymus glaucus var. brevior	blue wildrye
ELGLJ	Elymus glaucus var. jepsonii	Jepson's blue wildrye
ELYMUS	Elymus sp.	wildrye
ERCH7	Eriophorum chamissonis	Chamisso's cottongrass
FEOC	Festuca occidentalis	western fescue
FEPR	Festuca pratensis	meadow fescue
FERU2	Festuca rubra	red fescue
FESTUCA	Festuca sp.	fescue
GLBO	Glyceria borealis	northern mannagrass
GLGR	Glyceria grandis	reed mannagrass
GLYCERIA	Glyceria sp.	mannagrass
HOLA	Holcus lanatus	velvet grass
HOBR2	Hordeum brachyantherum	meadow barley
JUAC	Juncus acuminatus	tapertip rush
JUAR4	Juncus articulatus	jointleaf rush
JUBU	Juncus bufonius	toad rush
JUEF	Juncus effusus	common rush
JUEN	Juncus ensifolius	swordleaf rush
JUFA	Juncus falcatus	falcate rush
JUNCUS	Juncus sp.	rush
JUTE	Juncus tenuis	poverty rush
LEOR	Leersia oryzoides	rice cutgrass
LOMU	Lolium multiflorum	Italian ryegrass
LUCA2	Luzula campestris	rield woodrush
LUPA4	Luzula parviflora	small-flowered woodrush
PHAR3	Phalaris arundinacea	reed canarygrass
PHPR3	Phleum pratense	timothy grass
POTR2	Poa trivialis	rough bluegrass
PUPA3	Puccinellia pauciflora	weak alkaligrass
Species Code	Scientific Name	Common Name
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RHAL3	Rhynchospora alba	white beak-sedge
SCPA2	Scheuchzeria palustris	Scheuchzeria
SCAC	Scirpus acutus	hardstem bulrush
SCCY	Scirpus cyperinus	woolly sedge
SCMI2	Scirpus microcarpus	small-fruited bulrush
SCIRPUS	Scirpus sp.	bulrush
SPAN2	Sparganium angustifolium	narrowleaf burreed
TYLA	Typha latifolia	broadleaf cattail
ТҮРНА	Typha sp.	cattail
Forbs		
ACMI2	Achillea millefolium	yarrow
ACTR	Achlys triphylla	vanilla leaf
ADBI	Adenocaulon bicolor	pathfinder
ANMA	Anaphalis margaritacea	pearly everlasting
ANGE2	Angelica genuflexa	kneeling angelica
AQFO	Aquilegia formosa	red columbine
ARMI2	Arctium minus	burdock
ARAM2	Arnica amplexicaulis	streambank arnica
ARDO3	Artemisia douglasiana	Douglas sagewort
ARDIA	Aruncus dioicus var. acuminatus	goatsbeard
ASCA2	Asarum caudatum	wild ginger
ASMO3	Aster modestus	great northern aster
ASTER	Aster sp.	aster
BOEL2	Boykinia elata	coast Boykinia
BRSC	Brasenia schreberi	watershield
CARO2	Campanula rotundifolia	common harebell
CAOC	Cardamine occidentalis	big western bittercress
CAOL	Cardamine oligosperma	little western bittercress
CEBI2	Centaurea biebersteinii	spotted knapweed
CEUM	Centaurium umbellatum	European centaury
CEVI3	Cerastium viscosum	sticky chickweed
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Species Code	Scientific Name	Common Name
CHME	Chimaphila menziesii	little prince's pine
CHIMAPHILA	Chimaphila sp.	pipsissewa
CIIN	Cichorium intybus	chicory
CIDO	Cicuta douglasii	Douglas water hemlock
CIAL	Circaea alpina	small enchanter's nightshade
CIAR4	Cirsium arvense	Canada thistle
CIVU	Cirsium vulgare	bull thistle
CLUN2	Clintonia uniflora	queen's cup
COMAM6	Corallorhiza maculata	spotted coralroot
COST19	Corallorhiza striata	striped coralroot
COCA13	Cornus canadensis	bunchberry dogwood
CRCA3	Crepis capillaris	smooth hawksbeard
CREPIS	Crepis sp.	hawksbeard
DACA	Daucus carota	wild carrot
DIFO	Dicentra formosa	bleeding heart
DIPU	Digitalis purpurea	foxglove
DRRO	Drosera rotundifolia	roundleaf sundew
EPAN2	Epilobium angustifolium	fireweed
EPILOBIUM	Epilobium sp.	willowherb
EPWA3	Epilobium watsonii	rringed willowherb
ERPE3	Erigeron peregrinus	subalpine fleabane
ERPH	Erigeron philadelphicus	Philadelphia fleabane
FRVE	Fragaria vesca	wild strawberry
GALIUM	Galium sp.	bedstraw
GAAP2	Galium aparine	cleavers
GATR2	Galium trifidum	three petal bedstraw
GATR3	Galium triflorum	sweet scented bedstraw
GERO	Geranium robertianum	herb Robert
GEMA	Geum macrophyllum	large leaf avens
GOOB2	Goodyera oblongifolia	rattlesnake plantain
HEMA80	Heracleum lanatum	cow parsnip
HEMI7	Heuchera micrantha	small-flowered alumroot

Species Code	Scientific Name	Common Name
HIAL2	Hieracium albiflorum	white-flowered hawkweed
HICA10	Hieracium caespitosum	yellow hawkweed
HIERACIUM	Hieracium sp. (non-native)	invasive hawkweed
HYAN2	Hypericum anagalloides	bog St. John's wort
НҮРЕ	Hypericum perforatum	common St. John's Wort
HYRA3	Hypochaeris radicata	hairy cat's ear
HYMO3	Hypopitys monotropa	pinesap
LABI	Lactuca biennis	tall blue lettuce
LAMU	Lactuca muralis	wall lettuce
LACTUCA	Lactuca sp.	lettuce
LAGA2	Lamiastrum galeobdolon	yellow archangel
LACO3	Lapsana communis	nipplewort
LEVU	Leucanthemum vulgare	oxeye daisy
LICA10	Listera caurina	northwestern twayblade
LICO6	Listera cordata	heart-leaved twayblade
LOCO6	Lotus corniculatus	bird's foot trefoil
LUPINUS	Lupinus sp.	lupine
LYUN	Lycopus uniflorus	northern bugleweed
LYAM3	Lysichiton americanum	skunk cabbage
MADI	Maianthemum dilatatum	false lily of the valley
MADI6	Matricaria discoidea	disc mayweed
MEFA	Medicago falcata	yellow medic
MELU	Medicago lupulina	black medic
MEDICAGO	Medicago sp.	alfalfa
MEAL2	Melilotus alba	white sweetclover
MEAR4	Mentha arvensis	wild mint
METR3	Menyanthes trifoliata	bog buckbean
MIDE3	Mimulus dentatus	coast monkeyflower
MIGU	Mimulus guttatus	yellow monkeyflower
MOUN3	Monotropa uniflora	Indian pipe
MOPA2	Montia parvifolia	small-leaved Montia

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Species Code	Scientific Name	Common Name
MOSI2	Montia sibirica	Siberian springbeauty
MYLA	Myosotis laxa	small-flowered forget me not
MYSC	Myosotis scorpioides	marsh forget me not
NUPO2	Nuphar polysepala	yellow pond Lily
OESA	Oenanthe sarmentosa	water parsley
OSCH	Osmorhiza chilensis	mountain sweet cicely
OXST	Oxalis stricta	common yellow oxalis
PAVI3	Parentucellia viscosa	yellow glandweed
PEFR5	Petasites frigidus	sweet coltsfoot
PEPA31	Petasites palmatus	palmate coltsfoot
PLLA	Plantago lanceolata	English plantain
PLMA2	Plantago major	common plantain
PLST4	Platanthera stricta	slender bog orchid
РОНҮ	Polygonum hydropiper	marshpepper smartweed
POLA4	Polygonum lapathifolium	dockleaf smartweed
POLYG	Polygonum sp. (invasive)	invasive knotweed
POLYGONUM-N	Polygonum sp. (native)	knotweed
POFO3	Potamogeton foliosus	leafy pondweed
POPA14	Potentilla palustris	marsh cinquefoil
PRAL	Prenanthes alata	western rattlesnake root
PRVU	Prunella vulgaris	selfheal
PYASP	Pyrola asarifolia var. purpurea	liverleaf wintergreen
PYPI2	Pyrola picta	white-veined wintergreen
PYUN	Pyrola uniflora	single-flowered wintergreen
RAFL2	Ranunculus flammula	lesser spearwort
RAOC	Ranunculus occidentalis	western buttercup
RARE3	Ranuculus repens	creeping buttercup
RAUN	Ranunculus uncinatus	little buttercup
ROPA2	Rorippa palustris	bog yellowcress
RUAC3	Rumex acetosella	sheep sorrel
RUCR	Rumex crispus	curled dock
RUOC3	Rumex occidentalis	western dock

Species Code	Scientific Name	Common Name
RUMEX	Rumex sp.	dock
SAME7	Saxifraga mertensiana	wood saxifrage
SEJA	Senecio jacobaea	tansy ragwort
SESY	Senecio sylvaticus	common groundsel
SMRA	Smilacina racemosa	false solomon's seal
SMILACINA	Smilacina sp.	solomon's seal
SODU	Solanum dulcamara	purple nightshade
SOCA6	Solidago canadensis	Canada goldenrod
SOAS	Sonchus asper	spiny sowthistle
SOOL	Sonchus oleraceus	common sowthistle
SONCHUS	Sonchus sp.(annual)	sowthistle
SPRO	Spiranthes romanzoffiana	ladies' tresses
STCO14	Stachys cooleyae	Cooley's hedge nettle
STCR2	Stellaria crispa	curled starwort
STLO2	Stellaria longipes	longstalk starwort
STELLARIA	Stellaria sp.	starwort
STAM2	Streptopus amplexifolius	clasping-leaved twistedstalk
STRO4	Streptopus roseus	rosy twistedstalk
STREPTOPUS	Streptopus sp.	twistedstalk
TAVU	Tanacetum vulgare	common tansy
TAOF	Taraxacum officinale	common dandelion
TEGR2	Tellima grandiflora	fringecup
TITR	Tiarella trifoliata	foamflower
TIUN3	Tiarella unifoliata	oneleaf foamflower
TOGL2	Tofieldia glutinosa	sticky Tofieldia
TOME	Tolmiea menziesii	piggy back plant
TRCA	Trautvetteria caroliniensis	false bugbane
TRAR2	Trientalis arctica	northern starflower
TRBO	Trientalis borealis	western starflower
TRPR2	Trifolium pratense	purple clover
TRRE3	Trifolium repens	white clover
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Species Code	Scientific Name	Common Name
TRIFOLIUM	Trifolium sp.	clover
TROV2	Trillium ovatum	Pacific trillium
URDI	Urtica dioica	stinging nettle
VASC2	Valeriana scouleri	Scouler's valerian
VECA2	Veratrum californicum	California false hellebore
VEVI	Veratrum viride	green false hellebore
VETH	Verbascum thapsus	mullein
VEAM2	Veronica americana	American speedwell
VEBL2	Veronica biloba	two-lobe speedwell
VEOF2	Veronica officinalis	common gypsyweed
VERONICA	Veronica sp.	speedwell
VINCA	Vinca sp.	periwinkle
VIOLA	Viola sp.	violet
Lichens		
ALSA9	Alectoria sarmentosa	
ASPIC2	Aspicilia sp (aquatic)	
BRCA14	Bryoria capillaris	
BRFR60	Bryoria fremontii	
CAHU60	Cavernularia hultenii	
CECE4	Cetrelia cetrarioides	
CLAL11	Cladonia albonigra	
CLBE4	Cladonia bellidiflora	
CLCH3	Cladonia chlorophaea	
CLCO13	Cladonia coniocraea	
CLEC	Cladonia ecmocyna	
CLFI2	Cladonia fimbriata	
CLFU3	Cladonia furcata	
CLOC60	Cladonia ochrochlora	
CLPY60	Cladonia pyxidata	
CLSQ60	Cladonia squamosa	
CLTR60	Cladonia transcendens	
EVPR2	Evernia prunastri	

Species Code	Scientific Name
FUSA	Fuscopannaria pacifica (saubinetii)
GRSC3	Graphis scripta
НҮАР3	Hypogymnia appinata / enteromorpha
HYDU60	Hypogymnia duplicata
HYIM60	Hypogymnia imshaugii
HYIN2	Hypogymnia inactiva
HYME3	Hypogymnia metaphysodes
HYPH60	Hypogymnia physodes
HYTU60	Hypogymnia tubulosa
HYSI60	Hypotrachyna sinuosa
ICER	Icmadophila ericetorum
IOLA2	Ionaspis lacustrus
LOLI60	Lobaria linita
MEFU60	Melanelia fuliginosa
MELANELIA	Melanelia sp.
MESU60	Melanelia subaurifera
METE7	Menegazzia terebrata
NEBE60	Nephroma bellum
PASU63	Parmelia sulcata
PAAR61	Parmotrema arnoldii
PEBR21	Peltigera britannica
PECO60	Peltigera collina
PELE61	Peltigera leucophlebia
PENE12	Peltigera neopolydactyla
PEVE60	Peltigera venosa
PLGL60	Platismatia glauca
PLHE60	Platismatia herrei
PLNO60	Platismatia norvegica
PLST6	Platismatia stenophylla
PORPI2	Porpidia sp.
PSAN60	Pseudocyphellaria anomala
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Species Code	Scientific Name
PSOROMA	Psoroma sp.
RAFA60	Ramalina farinacea
SPGL60	Sphaerophorus globosus
STFU60	Sticta fuliginosa
STLI60	Sticta limbata
TUCH60	Tuckermannopsis chlorophylla
TUOR60	Tuckermannopsis orbata
USFI61	Usnea filipendula grp.
USLO50	Usnea longissima
USNEA2	Usnea sp.
USWI	Usnea wirthii
Bryophytes	
ANCU3	Antitrichia curtipendula
ATSE3	Atrichum selwynii
AUAN70	Aulacomnium androgynum
AUPA70	Aulacomnium palustre
BAPO70	Bartramia pomiformis
BADE6	Bazzania denudata
BRCA25	Bryum capillare
BRYUM	Bryum sp.
CAFI12	Calypogeia fissa
CEBI4	Cephalozia bicuspidata
CEPU12	Ceratodon purpureus
CHPO14	Chilocyphus polyanthos
CLCR4	Claopodium crispifolium
COCO38	Conocephalum conicum
DEAB	Dendroalsia abietina
DIFU5	Dicranum fuscescens
DISC71	Dicranum scoparium
DITA	Dicranum tauricum
DICI5	Dicraoweisia cirrata
DIVI13	Didymodon vinealis

Species Code	Scientific Name
DIAL11	Diplophyllum albicans
DOOV	Douinia ovata
DREPANOCLADUS	Drepanocladus sp.
EUOR2	Eurhynchium oreganum
EUPR7	Eurhynchium praelongum
FIGR	Fissidens grandifrons
FOAN2	Fontinalis antipyretica
FRNI3	Frullania nisquallensis
HOFU70	Homalothecium fulgescens
HONU	Homalothecium nutallii
HOLU	Hookeria luscens
HYSP70	Hylocomium splendens
HYCI70	Hypnum circinale
HYSU70	Hypnum subimponens
ISMY2	Isothecium myosuroides
JUNGE	Jungermannia sp.
LERE17	Lepidozia reptans
LEAC8	Leucolepis acanthoneuron
MAEM4	Marsupella emarginata
MEME8	Metaneckera menziesii
MECO19	Metzgeria conjugata
NEDO70	Neckera douglasii
ORCO10	Orthotrichum consimile
ORLY	Orthotrichum Iyellii
PLIN11	Plagiomnium insigne
PLUN4	Plagiothecium undulatum
POAL24	Polytrichastrum alpinum
POALA2	Polytrichum alpinum
POJU70	Polytrichum juniperinum
PONA7	Porella navicularis
PORO14	Porella roellii
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Species Code	Scientific Name
POBI15	Porotrichum bigelovii
PSEL3	Pseudotaxiphyllum elegans
RACA11	Racomitrium canescens
RABO5	Radula bolanderi
RACO19	Radula complanata
RHGL70	Rhizomnium glabrescens
RHNU4	Rhizomnium nudum
RHLO70	Rhytidiadelphus loreus
RILA6	Riccardia latifrons
RIMU3	Riccardia multifida
SCAM3	Scapania americana
SCBO4	Scapania bolanderi
SCUM3	Scapania umbrosa
SCOB5	Scleropodium obtusifolium
SCAQ2	Scouleria aquatica
SPHAGNUM	Sphagnum sp.
SPSQ70	Sphagnum squarrosum
TEPE70	Tetraphis pellucida

Bold text indicates target weed species

Appendix F

Responses to Draft Report Comments

STAKEHOLDER COMMENT	LICENSEE RESPONSE
Ann Risvold – US Forest Service – Letter 1/16/2008	
Page 6 and 7, Table 3-1:	Revisions made to Table 3-1 to note documented occurrences of
the following species are documented on the MBSNF – yellow	these species.
hawkweed, wild carrot, yellow archangel, and elephant ear. The	
species hairy willow-herb is not documented, as far as I know.	
Ann Risvold – US Forest Service – Email 1/17/2008	
I don't see a need to meet, unless our change in policies is	No response necessary.
becoming too confusing. Kathy Smayda has done a fine job with	
the studies and reports.	
Rich Johnson – WA Department of Fish and Wildlife – Email	
1/17/2008	
I don't know enough about plants to provide any comments. I did	No response necessary.
look at the reports, and was amazed at how many different species	
they identified!	
David Turner – FERC – Email 1/22/2008	
Page 10, Section 3.1.3.4—	'Powerhouse' added to the bulleted item on page 10.
River access on DNR lands near. Near what?	
Page 34, Section 5.3, last sentence of first paragraph—	Revision made.
change probed to proven to be.	