Appendix D: How this Project Complies with the Northwest Forest Plan and Pacfish/Infish Aquatic Conservation Strategies

Introduction

Appendix D contains an integrated analysis from the interdisciplinary team regarding how the invasive plant treatment project follows the Northwest Forest Plan and Pacfish/Infish Aquatic Conservation Strategies. It is consistent with the individual resource sections in Chapter 3 of the EIS, however the information is organized by aquatic conservation objectives which integrate the botany, wildlife, soils, water, and fish resource areas.

The Northwest Forest Plan directs the Forest Service to manage riparian-dependent resources to maintain the existing condition or implement actions to restore conditions (USDA USDI 1994a). Invasive plant treatments and subsequent re-establishment of native vegetation would lead to improved riparian conditions, and would not degrade riparian or aquatic habitats.

Current infestations cover less than 1 percent of the acreage within Riparian Reserves (invasive plants are mapped on less than 1/10th of 1 percent within most 5th field watersheds, see Chapter 3.8). Based on the current need and treatment limits associated with the project, less than one half of one percent of National Forest system land and less than ten percent of the Riparian Reserve/Riparian Habitat Conservation Area (RHCA) acreage in any 6th field watershed would be treated annually.

Not only is the affected area within watersheds very small, analysis in DEIS Chapters 3.5 and 3.6 indicates that the proposed actions are not likely to result in meaningful adverse effects to riparian and aquatic habitats. The proposed project has a risk of adding some minor amounts of sediment and herbicide to surface water, but the amount is insignificant and not expected to affect watershed function because of PDFs limiting rates of application, types of application, and distance from water. Most of the treatments areas are previously disturbed landings, roadways and trails so ground disturbance is not a substantial concern and manual/mechanical treatments would not add to that disturbance. Modification of surface ground cover over a substantial area can also change the timing of run-off, however in this case, no effects on stream flow are plausible because the scale of treatment is so small and some ground cover will likely remain on all treated sites.

Removal of some invasives would reduce cover and shade for a short period of time along the stream's edge, but not enough to change water temperature in a stream. Since only Japanese knotweed is providing shade on 0.5 acres of treatment over the entire forest, no changes in water temperature are expected in any watershed. One reason treatment of invasive plants is being proposed is to recover vegetation structure and, in time, provide more stream shade with the establishment of native deciduous shrubs and trees. The PDFs prohibit broadcast applications to invasive plants within 100 feet of live water. This would protect overhanging non-target vegetation and smaller trees that are currently providing shade closest to the stream and other waterbodies.

Proposed invasive plant treatments that would take place near streams are consistent with the recommendations found in Watershed Analysis and applicable standards and guidelines from the Northwest Forest Plan and PacFish/InFish. The proposed invasive plant treatments are expected to aid in

restoration of riparian habitat by allowing native vegetation to return to sites currently invested by invasive plants.

Northwest Forest Plan Aquatic Conservation Strategy Objectives

The following is a summary of how this project compares to each of the Aquatic Conservation Strategy (ACS) Objectives.

***ACS Objective #1**: Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.*

Invasive plants have the potential to adversely affect the distribution, diversity, and complexity of watershed scale features (such as riparian areas) because they displace native vegetation. Invasive plant treatment has the potential to reduce or eliminate this effect by restoring native vegetation. Alternative 2 poses more potential short-term (1-year) risks of herbicide input to streams and increase in stream temperature then Alternative 3 (because more acres can be treated annually given a constant budget), but more potential long-term (>1-year) benefits to riparian vegetation and overall watershed/aquatic condition.

This project does not involve activities such as road building or logging that could fragment aquatic habitat. Channel components that contribute to channel complexity (pool quantity and quality, substrate, flows) would be maintained because invasive plant treatments would have no impact on those features. Proposed invasive plant treatments are expected to aid in restoration of riparian reserve conditions by allowing native vegetation to return to sites currently infested by invasive plants.

***ACS Objective #2**: Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.*

Riparian areas and associated streams and floodplains are essential to providing connectivity within and between watersheds. Invasive plant spread has the potential to threaten connectivity as watershed scale features (such as riparian areas) lose native plant composition and are displaced by less desirable, non-native invasive species. Treatments do not have the potential to threaten watershed connectivity.

***ACS Objective #3:** Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.*

Alternative 1 would not likely maintain and restore the physical integrity of aquatic systems. By not treating the majority of invasive plant populations including within riparian areas, there is potential for loss of aquatic system integrity. The potential for alteration of banks, shorelines, and bottoms is low in the short term (1-year), but as invasive plant populations expand the potential for alteration is greater. The amount of alteration depends primarily on the species of invasive plant and its rooting structure. Some invasive plants have good rooting structure while others do not. However, left unchecked, water-tolerant invasive species can choke out streams and lead to channel deposition, hence alteration in channel morphology. Changes in channel morphology would happen over time (>10 years).

Due to its cost effectiveness, Alternative 2 would do the most to protect and restore the physical integrity of aquatic systems. Treatment of invasive plants near streams would allow for re-establishment of native riparian plants that typically have better root structure (and bank holding capacity) than non-native invasive plants. Project design features including applying erosion control measures, modifying application methods close to channels, using the lowest effective rates, and protecting non-target vegetation would protect the aquatic systems during treatment.

Under an unlimited budget, both action alternatives have the potential to restore watershed integrity.

ACS Objective #4*: Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.*

Alternative 1 would not maintain and restore water quality to support healthy ecosystems. Riparian areas that are untreated would continue to lose native vegetation. Alternative 2 would treat more invasive plants within riparian areas with more cost-effective methods than Alternative 3. Because of this, Alternative 2 provides more opportunity for eradication of invasive plants and re-establishment of native riparian vegetation. The potential for herbicides to enter a live water system are inherently greater in Alternative 2, but BMP's included in PDFs have been designed to prevent potential degradation of water quality from herbicides and substantial adverse effects are not predicted.

Since the proposed action would not change stream shading levels and thus not measurably effect water temperatures there would not be any incremental effect on 303d streams segments listed for temperature from this project. In the long term treating invasive plants would promote beneficial riparian vegetation and may slightly improve water temperatures in 303d listed streams.

In addition, the amount of work to be done that could contribute sediment is very small and PDFs (Chapter 2.2.2) aimed at reducing erosion would maintain the overall sediment levels in the long term (>1 year). There is a low risk of a short term (<1 year), very limited increase at sites where invasive plants are removed, that would last until native vegetation and/or effective ground cover was restored.

ACS Objective #5: *Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.*

The current population of invasive plants has a non-measurable effect to the current sediment regime of waterbodies. However, with the projected expansion of invasive plants this could be more of a problem over the next 15 years and beyond if cost-effective invasive plant treatments are not approved. Invasive plants in riparian areas can cause a loss of functional riparian communities, loss of rooting strength and result in less protection against erosion, and subsequent impacts on water quality (Donaldson 1997).

Alternative 2 provides more opportunity for eradication of invasive plants and reestablishment of native riparian vegetation. However, given a limited budget, Alternative 2 would likely treat more areas close to live water, so the potential for short-term (<1 year) sediment delivery to streams is inherently greater than that of Alternative 3. However, PDFs have been designed to mitigate potential erosion. Over the longer term (>1 year) erosion is expected to decrease as native vegetation re-establishes. Based on the low

intensity of the ground disturbance and the small number and dispersion of acres treated, sediment delivery should be negligible and turbidity should not increase measurably.

ACS Objective #6: *Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected. AND* ***ACS Objective #7:*** *Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.*

Invasive plants do not affect stream flows, and treatment would not remove enough vegetation over a large enough area to affect flows. All alternatives would maintain in-stream flows. There is no potential for increased peak flows or alteration of the timing, magnitude, duration and spatial distribution of flows as a result of treating/not treating invasive plants. All alternatives would maintain the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands because these elements are not affected by invasive plants or their removal.

ACS Objective #8: *Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.*

AND ***ACS Objective #9:*** *Maintain and restore habitat to support well-distributed populations of native plant invertebrate and vertebrate riparian-dependent species.*

Continued growth in invasive plant populations would continue to degrade the species composition and structural diversity of plant communities in riparian areas. Effective treatment of invasive plants would maintain and restore species composition and structural diversity of plant communities in riparian areas. Alternative 2 has the best chance of restoring riparian vegetation because it is most cost effective (Chapter 3.2.4). Alternative 1 has the least chance of restoring riparian vegetation (ibid.). Treatment of invasive plants will not degrade composition, diversity or habitat within riparian areas (see Chapters 3.3, 3.4, 3.5, 3.6 and 3.7).

PACFISH/INFISH Goals and Objectives

The following is a summary of how the action alternatives of this project comply with the PACFISH/INFISH Strategies for managing anadromous and inland fisheries.

PACFISH/INFISH Goals

Goal 1: *Maintain or restore water quality, to a degree that provides for stable and productive riparian and aquatic ecosystems.*

Water quality would be maintained. Project Design Features minimize the possibility that herbicides would enter water and impact water quality. Concentrations of herbicides reaching streams are expected to be well below concentrations of concern to beneficial uses and risks have been minimized or eliminated by buffers and PDFs.

Water quality is unlikely to be degraded by sediment produced from removal of invasive plants. The invasive plant populations on the Okanogan Wenatchee National Forest are not extensive enough to result in significant sediment/turbidity and emergent vegetation will not be treated. Exposed stream banks are expected to re-vegetate during the spring/summer following treatment. In addition, site restoration and re-vegetation methods preclude erosion as a result of herbicide treatment. It is expected that most patches would be relatively small and any erosion negligible.

Treating invasive plants would improve riparian stability where invasive plants have colonized along stream channels and out-competed native species. For instance knotweed has poor bank holding capacity, which leads to more bank erosion and sedimentation of streams in high winter flows (R6 PNW FEIS).

Diffuse and spotted knapweed is found along many streams in the Forest. Lacey et al. (1989) reported higher runoff and sediment yield on sites dominated by knapweed versus sites dominated by native grasses. Thus, restoration of native vegetation in areas currently dominated by knapweed could restore water quality over time.

Goal 2*: Maintain or restore stream channel integrity, channel processes, and the sediment regime (including the elements of timing, volume, and character of sediment input and transport) under which the riparian and aquatic ecosystems developed.*

The current population of invasive plants has a non-measurable effect to the current sediment regime of waterbodies. However, with the projected expansion of invasive plants this could be more of a problem over the next 15 years and beyond if cost-effective invasive plant treatments are not approved. Invasive plants in riparian areas can cause a loss of functional riparian communities, loss of rooting strength and result in less protection against erosion, and subsequent impacts on water quality (Donaldson 1997).

Alternative 2 provides more opportunity for eradication of invasive plants and reestablishment of native riparian vegetation. However, given a limited budget, Alternative 2 would likely treat more areas close to live water, so the potential for short-term (<1 year) sediment delivery to streams is inherently greater than that of Alternative 3. However, PDFs have been designed to mitigate potential erosion. Over the longer term (>1 year) erosion is expected to decrease as native vegetation re-establishes. Based on the low intensity of the ground disturbance and the small number and dispersion of acres treated, sediment delivery should be negligible and turbidity should not increase measurably.

Goal 3*: Maintain or restore instream flows to support healthy riparian and aquatic habitats, the stability and effective function of stream channels, and the ability to route flood discharges.*

And ***Goal 4:*** *Maintain or restore natural timing and variability of the water table elevation in meadows and wetlands.*

Invasive plants do not affect stream flows, and treatment would not remove enough vegetation over a large enough area to affect flows. All alternatives would maintain in-stream flows. All alternatives would maintain the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands because these elements are not affected by invasive plants or their removal.

Goal 5*: Maintain or restore diversity and productivity of native and desired non-native plant communities in riparian zones.*

Continued growth in invasive plant populations would continue to degrade the species composition and structural diversity of plant communities in riparian areas. Effective treatment of invasive plants would maintain and restore species composition and structural diversity of plant communities in riparian areas. Alternative 2 has the best chance of restoring riparian vegetation because it is most cost effective (Chapter 3.2.4). Alternative 1 has the least chance of restoring riparian vegetation (ibid.). Treatment of invasive plants will not degrade composition, diversity or habitat within riparian areas (see Chapters 3.3, 3.4, 3.5, 3.6 and 3.7).

Goal 6: *Maintain or restore riparian vegetation, to:*

> *(a) provide an amount and distribution of large woody debris characteristic of natural aquatic and riparian ecosystems;*
>
> *(b) provide adequate summer and winter thermal regulation within the riparian and aquatic zones; and*
>
> *(c) help achieve rates of surface erosion, bank erosion, and channel migration characteristic of those under which the communities developed.*

Invasive plants do not provide large woody debris to streams. They can adversely influence thermal regulation by outcompeting shade-producing vegetation. Some invasive plants have limited soil holding capacity and result in accelerated erosion. A good example is knotweed. This invasive plant chokes waterways, displaces native plants, and erodes riverbanks (USDA 2015). Knotweed creates its own monoculture, leaving stream banks susceptible to increased erosion as it loses its leaves during the rainy season (ibid). Removal of knotweed can help promote establishment of more desirable plants, especially if active restoration methods are employed (ibid). About 0.5 acres of knotweed are mapped along streams in the project area.

Some minor bank erosion may occur from removing invasive plants in locations where invasive plants have taken over a stream bank, especially in smaller streams. For example, killing knapweed with an herbicide would de-vegetate a portion of the stream bank and result in a loss of roots that help to hold soil particles together. This may expose stream banks at higher flows and result in some erosion. The total spatial extent of heavy infestations along stream banks within the action area is low and impacts are unlikely to influence bank erosion rates at a meaningful scale.

Goal 7*: Maintain or restore riparian and aquatic habitats necessary to foster the unique genetic fish stocks that evolved within the specific geo-climatic region.*

There is no indication that this project would influence fishery genetics or the long term viability of fisheries on the Forest.

Goal 8: *Maintain or restore habitat to support populations of well-distributed native and desired non-native plant, vertebrate, and invertebrate populations that contribute to the viability of riparian-dependent communities.*

Invasive plant treatment would help maintain or restore riparian vegetation threatened by invasive plants. Native riparian vegetation plays a key role in forming aquatic habitat for fish and other aquatic species.

Roots help stabilize stream banks, preventing accelerated bank erosion and providing for the formation of undercut banks, important cover for juvenile and adult fish. Native riparian vegetation also provides large and small wood to streams, adding to habitat complexity and providing cover and food sources for aquatic organisms. These services are not provided by invasive plants. Treatment of invasive plants in riparian areas would help maintain or restore native plant communities that contribute to a healthy riparian condition.

Invasive plant treatment may have short term impacts on some elements of the riparian ecosystem (there is a potential for some common native plants to be killed); however, the impacts would be very small scale (limited to the area directly adjacent to treatment) and short term (vegetation would rebound within one season). This is based on the characteristics of the herbicides proposed for use, the PDFs that limit the application method, Long term benefits to the development of native plants and riparian dependent ecosystems are possible from removal of invasive plants. No broadcast herbicide application would occur within 100 feet of wet streams in any alternative. This provides protection to the recruitment of conifer seedlings within riparian areas which will sustain channel and habitat features in the future.

PACFISH/INFISH RMOs

PACFISH-INFISH Riparian Management Objective (RMOs) were considered to determine whether there is any potential effect that could be invasive plant by invasive plant treatments, especially herbicide use.

General Riparian Area Management

Table E-2. INFISH/PACFISH Interim Riparian Management Objectives

Habitat Feature	Interim Objectives
Pool Frequency (kf[1]) (all systems)	Varies by channel width (see Table E-3)
Water Temperature (sf[2])	No measurable increase in maximum water temperature (7-day moving average of daily maximum temperature measured as the average of the maximum daily temperature of the warmest consecutive 7-day period). INFISH: Maximum water temperatures below 59°F within adult holding habitat and below 48°F within spawning and rearing habitats. PACFISH: Maximum water temperatures below 64°F within migration and rearing habitats and below 60°F within spawning habitats.
Large Woody Debris (sf) (forested systems)	Coastal California, Oregon and Washington: >80 pieces per mile; >24 inch diameter; >50foot length. East of Cascade Crest in Oregon, Washington, Idaho: >20 pieces per mile; >12 inch diameter, > 35 foot length
Bank Stability (sf) (non-forested systems)	>80 percent stable.
Lower Bank Angle (sf) (non-forested systems)	>75 percent of banks with <90 degree angle (i.e., undercut).
Width/Depth Ratio (sf) (all systems)	<10, mean wetted width divided by mean depth.

[1] Key feature
[2] Supporting feature

Table E-3 Interim objectives for pool frequency

Wetted Width (feet)	10	20	25	50	75	100	125	150	200
Pools per mile	96	56	47	26	23	18	14	12	9

Pool Frequency

There is no possibility that invasive plants or treatment of invasive plants would impact pool area, quality and frequency.

Water Temperature

Most invasive plants provide little shade, so removal of these plants is unlikely to have any measurable effect to stream temperature. Since the proposed action would not change stream shading levels and thus not measurably effect water temperatures there would not be any incremental effect on 303d streams segments listed for temperature from this project. In the long term treating invasive plants would promote beneficial riparian vegetation and may slightly improve water temperatures in 303d listed streams.

Large Woody Debris

Treatment of invasive plants in RHCAs would not impact woody debris in streams. No broadcast application would occur within 100 feet of wet streams. This measure provides protection to the recruitment of conifer seedlings within riparian areas which will sustain channel and habitat features in the future. Controlling invasive plants would allow for reestablishment of native vegetation, allowing riparian stands over time to develop larger recruitment trees, increasing the size and quantity of in-channel debris.

Bank Stability

Some minor bank erosion may occur from removing invasive plants in locations where invasive plants have taken over a stream bank, especially in smaller streams. For example, killing knapweed with an herbicide would de-vegetate a portion of the stream bank and result in a loss of roots that help to hold soil particles together. This may expose stream banks at higher flows and result in some erosion. The total spatial extent of heavy infestations along stream banks within the action area is low and impacts are unlikely to influence bank erosion rates at a meaningful scale.

Lower Bank Angle

There is no risk of negatively impacting channel condition and dynamics as a result of treating invasive plants and there are no possible adverse effects on lower bank angle.

Width/Depth Ratio

There is no risk of negatively impacting channel condition and dynamics as a result of treating invasive plants. Thus, there are no possible adverse effects on channel condition and dynamics.

NWFP ACS: *Herbicides, insecticides, and other toxicants, and other chemicals shall be applied [within riparian reserves] only in a manner that avoids impacts that retard or prevent attainment of Aquatic Conservation Strategy objectives.*

PACFISH/INFISH: *Apply herbicides, pesticides, and other toxicants, and other chemicals in a manner that does not retard or prevent attainment of Riparian Management Objectives and avoids adverse effects on inland native fish.*

Summary

Invasive plant treatment complies with the ACS, and PACFISH and INFISH, and specifically standard RR (RA)-3. None of the alternatives would retard the attainment or maintenance of ACS objectives or PACFISH/INFISH RMOs or goals. None of the herbicide or non-herbicide treatments, including aerial herbicide application, would disturb soils or channel features to the point of degrading bank stability, water temperature, lower bank angle of the creek, amount of large woody debris, or width to depth ratio.

While treatment (especially manual) may result in some ground disturbance and possible sedimentation, the amount would be low. There could be small localized areas of erosion and subsequent sediment input to the stream. These effects would be transitory and too small to measure. Pulling weeds along stream banks could also destabilize the banks in highly localized areas. These small treated areas are expected to revegetate within a season. As most of the treatments areas are previously disturbed roadways and trails, it is unlikely that the small additional ground disturbance would be a significant change from the existing condition. Over time, removal of invasive plants could improve habitat indicators as native vegetation recovers on the treated sites. Without treatment, all of these species are expected to continue to spread. Where they spread, banks could become less stable, leading to changes in suspended sediment and substrate character and embeddedness.

The low levels of herbicide used in riparian areas are not expected to affect fish. The Project Design Features would limit activities along stream banks when fish are spawning. Areas of high quality riparian habitat are distant from roads and contain very few sites. These areas would not have any measurable impacts from herbicide use and would continue to function as strongholds for recovery efforts.