NORTH ZONE WEED MANAGEMENT PROJECT | Aquatic Organisms Report

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For:

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Introduction

This report focuses on effects to aquatic organisms if they were exposed to the herbicides proposed for use in this project: aminopyralid, glyphosate, imazapyr and metsulfuron methyl. It also analyzes the effects of mechanical and manual treatments of non-native targeted species (hereafter called weeds) on aquatic organisms.

Exposures of aquatic organisms to herbicides could occur through drift, leaching, and runoff. Manual and mechanical treatment methods could increase sediment and erosion, temperature, and disturb spawning fish and incubating eggs. The likelihood of harm from herbicides and manual and mechanical treatments is unlikely due to the limited infestations of weeds near streams, the use of only aquatically approved herbicides near water, and Project Design Features (PDFs) that are in place to minimize or eliminate any potential adverse effects. The effects of weed treatments on water quality (including sediment, erosion, and temperature) and riparian management areas is described and discussed in the Hydrology Resource Report for this project (Whitacre 2019).

Proposed Action

The proposed action uses integrated weed control methods that include manual treatments (e.g. hand pulling, tarping), mechanical treatments (e.g., torching, mowing), and use of herbicides (e.g. spot, hand/selective, and broadcast spraying) to reduce, contain, or eliminate populations of weeds on the Juneau, Hoonah, Sitka, Yakutat Ranger Districts and Admiralty National Monument of the Tongass National Forest. This proposed action provides the flexibility to treat presently unknown infestations and acreages utilizing the adaptive management tool Early Detection-Rapid Response (EDRR). EDRR is an adaptive management tool included in this analysis to address ever-changing weed infestations, and allow District staff to respond to the discovery of new or previously undiscovered infestations within the project area. Early detection and rapid containment of target weeds is the most efficient method for controlling their spread in terms of time and money.

Glyphosate, aminopyralid, imazapyr and metsulfuron methyl, four herbicides with different chemical properties and modes of action (how the herbicide kills the plant), were selected for this project and are included in the suite of control methods analyzed for this project. Herbicide application is proposed using only three ground-based methods, which are spot, broadcast spraying, and selective hand spraying that target individuals and groups of plants based on accessibility, topography, and size of infestation. The vast majority of infestations in the project area are terrestrial and occur immediately adjacent to road and trail systems. In some cases, herbicide will also be applied directly over the water for purposes of treating emergent plants (plants rooted in water with the foliage above the water surface). In these situations only aquatic versions of glyphosate and imazapyr will be used. Treatment areas could include perennial and wet intermittent streams, wet ditches, wetlands, saturated soils, and lakes and ponds. Aminopyralid and metsulfuron methyl would only be used terrestrially and not in any aquatic scenario. Because the aquatic formations of glyphosate and imazapyr have negligible effects to aquatic organisms and water quality, avoiding impacts to non-targeted riparian and macrophyte vegetation is the primary concern when using herbicides, and the impacts to fish, amphibians, and invertebrates are of secondary concern.

Common Terminology

The toxicology and risk assessments fields contains terms commonly used, and necessary to describe the technical information, which are not typically found in other fields. The following list of terms (Table 1) is included to assist the reader.

Table 1. Common terminology referred to within report.

Acute exposure- A single exposure of multiple brief exposures occurring within a short time (e.g. 24 hours of less in humans)

Acute toxicity- Any harmful effect produced in an organism through an acute exposure to one or more chemicals.

a.e.- acid equivalent

Chronic Exposure-Exposures that occur over the average lifetime or for a significant fraction of the lifetime of a species. Chronic exposure studies evaluate the carcinogenic potential of chemicals and other long-term health effects.

EEC- Estimated/expected environmental concentration: The estimated or expected pesticide concentration in an environmental media based on a particular set of assumption and/or models.

HQ- Hazard Quotient: The ratio of the estimated level of exposure to a substance from a specific pesticide application to the reference dose for that substance, or some other index of acceptable exposure or toxicity (e.g. toxicity index). A HQ less than or equal to 1 is presumed to be negligible where no toxicity is detected above the reference. HQs between 1 through 10 highlight possible concern because toxicity levels are detectable, and HQs greater than 10 displays that effects from these higher concentrations require further analysis to determine risk to aquatic organisms.

LC_{50}/EC_{50}- lethal concentration$_{50}$/environmental concentration$_{50}$- A calculated concentration of a chemical in air or water to which exposure for a specific length of time is expected to cause death in 50 percent of a defined experimental animal or plant population.

LOC- Level of Concern: The concentration in media or some other estimate of exposure above which there may be effects.

NOEL or NOEC- No observed effect level/concentration: exposure level at which there are no statistically or biological significant differences in the frequency or severity of adverse effects between the exposed populations and its appropriate control.

Toxicity index- The benchmark dose used in this analysis to determine a potential adverse effect when it is exceeded. Usually a NOEL, but when data are lacking other values may be used. For example a value equal to 1/20th of the known LC50 may be used as a toxicity index.

LOAEL- Lowest observable adverse effect level

Overview of Issues Addressed

Issue Statement

Herbicide use may result in chemicals reaching streams and other water bodies (through drift, leaching or runoff) and adversely affect aquatic organisms and habitat.

Background

There are no listed threatened, endangered or sensitive fish or amphibian species on the Tongass National Forest (see Fisheries Biological Evaluation). The proposed action will minimize potential for herbicide delivery to surface waters and wetlands. Proposed herbicide use will not contaminate drinking water and water quality standards will be met (Whitacre 2019). However, the risk that some chemicals may reach surface waters and adversely affect aquatic organisms cannot be eliminated. Treatment extent, rate and method of application, and the properties of the chemicals proposed influence the degree of risk.

Issue Measures

- Type and extent of herbicide use within riparian areas (areas where herbicide use has potential to reach streams) and other water bodies; and road drainage networks near streams.
- Potential for harm to aquatic organisms.

Project Design Features for Aquatic Resources

Project design features (PDFs) will be applied during implementation to minimize or eliminate the potential for weed treatments to adversely affect water quality and aquatic organisms.

The design features below are intended to minimize the potential impacts of herbicide use on aquatic resources. These criteria will be implemented as necessary according to the invasive treatment plan updated annually. These PDFs are consistent with those designed for water quality and Riparian Management Areas (Whitacre 2019). Appropriate Best Management Practices (BMPs) (USDA 2006, 2012) will be followed throughout the projects to reduce or prevent negative impacts to non-target resources include the following:

- Aquatic resource specialists will annually review weed management plans to identify higher risk areas which may warrant field visits prior to implementation (Chem-3).
- Hand crews will stay out of flowing or ponded water whenever possible.
- If hand removal, herbicide application on stream bank, or spraying of emergent weeds requires entry into flowing or ponded water, walk carefully and limit time in the water. Coordinate with aquatics personnel to minimize potential impact to alevin or young-of-year salmonids.
- Limit herbicide use to the lowest application rates required to be effective.
- If foliar/spot spraying application is required, the following techniques will be used to minimize drift (BMP 15.2, Chem-2):
    - Label directions regarding wind speed and temperature will be followed.
    - Within riparian management areas, herbicides will only be sprayed in a downward direction. If target plants are taller than three feet, the plants will be laid down and sprayed.
    - All spraying within riparian area will be with a hand-held wand from a backpack style sprayer.
- Buffers / Spray Distance to Water (BMP 14.6, Chem-3)

    - Begin application of herbicide products nearest to the aquatic habitat boundary and proceed away from the aquatic habitat; do not apply towards a water body.
    - Aquatic-based formulations of all herbicides may be applied up to water's edge using hand application, spot spraying, or broadcast techniques. Aquatic-based formulations of glyphosate and imazapyr may also be used to treat emergent vegetation directly over water using hand application or spot spraying.
- Apply erosion control measures (e.g. silt fences or shut down periods) and native revegetation (e.g. mulching, native grass seeding, planting) for manual or chemical treatment where detrimental soil disturbance or de-vegetation may result in the delivery of measurable levels of fine sediment. (BMP 12.17, Veg-2)
- A Pesticide Use Permit (PUP) and an Alaska Pollutant Discharge Elimination System (APDES) permit must be obtained from the State of Alaska Department of Environmental Conservation prior to herbicide use for any applications into "waters of the US" (e.g. aquatic sites) (Chem-1)
- Weather Conditions (Chem-3)
    - Consider current and recent meteorological conditions. Rain events may increase pesticide runoff into adjacent water bodies. Saturated soils may inhibit pesticide penetration. Check forecast before applying any herbicides.
    - Herbicide will not be applied during or immediately prior to extreme rain events
    - Do not spray any liquid chemical substance when wind speeds exceed 7 mph.
- The Herbicide Transportation, Handling, and Emergency Spill Response Plan and spill kit will be on-site when herbicide treatment methods occur. This Plan will include reporting procedures, project safety planning, methods of clean-up of accidental spills, and information including a spill kit contents and location as noted in Forest Service Manual (FSM) 2150 (USFS 1994b), Pesticide-Use Management and Coordination and Handbook (FSH) 2109.14 (USFS 1994a). (BMP 15.4, Chem-3, Chem-5, Fac-7)
    - No more than daily use quantities of herbicides will be transported to the project site. The exception is for crews staging in remote locations. Under these circumstances, they can bring sufficient quantities of herbicides to last for the planned duration of the field work (i.e. multiple days).
    - Equipment used for transportation, storage, or application of herbicides will be maintained in a leak-proof condition.
    - Herbicide containers must be secured and prevented from tipping during transport.
    - To reduce the potential for spills, impervious material, such as a bucket or plastic, will be placed beneath mixing areas in such a manner as to contain any spills associated with mixing/refilling.
    - Immediate control, containment, and cleanup of fluids and herbicides due to spills or equipment failure (broken hose, punctured tank, etc.) will be implemented. All contaminated materials will be disposed of promptly and properly to prevent contamination of the site. All hazardous spills will be reported immediately to the Forest Hazardous Spill Coordinator.
    - Herbicide spray equipment will not be washed or rinsed within 150 feet of any body of water or stream channel. All herbicide containers and rinse water will be disposed of in a manner that would not cause contamination of waters.
    - Mixing and loading of herbicide(s) will take place a minimum of 150 feet away from any body of water or stream channel unless prior approval is obtained from a Forest Service hydrologist or biologist.

Affected Environment

Existing Condition

The project area occurs within the boundary of the 8.3 million acre Juneau, Hoonah, Sitka, Yakutat Ranger Districts and Admiralty National Monument. The project area contains 1,412 acres of known weed infestations consisting of 144 known species of weeds. It also contains 469 6^{th} level HUC watersheds which contain approximately 28,475 miles of Class I stream (anadromous fish) and 20,002 miles of Class II (resident fish only streams) (Appendix A). There are approximately 87 acres and 61 species of known weed infestations within riparian management areas (RMAs) near or along Class I -III streams in the project area (Appendix A). RMA distances range from 100 to 140 feet from the bankfull width of a stream depending on the process group of the stream (see Hydrology report for more information on RMAs and process groups). Known weed infestations can occur anywhere from the water's edge up to 140 feet horizontal distance perpendicular to a stream depending on process group of the stream. In rare cases, weeds are found within the water column as standing aquatic vegetation along stream banks and land and pond margins. The risk of sediment reaching the stream from these distances is low.

Indigenous fish species important to recreational, subsistence, personal use, and commercial fishing within the project area include Coho Salmon (*Oncorhynchus kisutch*), Pink Salmon (*Oncorhynchus gorbuscha*), Chinook Salmon (*Oncorhynchus* tshawytscha), Sockeye Salmon (*Oncorhynchus nerka*), and Chum Salmon (*Oncorhynchus keta*), steelhead, an anadromous form of Rainbow Trout (*Oncorhynchus mykiss*), coastal Cutthroat Trout (*Oncorhynchus clarki clarki*), Dolly Varden char (*Salvelinus malma*), and Eulachon (*Thaleichthys pacificus*) (Johnson and Blanche 2012). Fish populations within the project area are managed and protected by the Alaska Department of Fish and Game sport fishing regulations, personal use regulations, and daily harvest limits. Subsistence fishing is managed by the Federal Subsistence Board of Fish.

Amphibian species present in the project area include the northwestern salamander (*Ambystoma gracile*), long-toed salamander (*Ambystoma macrodactylum*), roughskin newt (*Taricha granulosa*), western toad (*Bufo boreas*), wood frog (Lithobates sylvaticus), the Columbia spotted frog (*Rana luteiventris*), and most recently, the invasive northern red-legged frog (*Rana aurora*) (MacDonald 2010).

Sensitive, Threatened, and Endangered Species

Several of the fish species present in the project area are threatened and endangered in the Pacific Northwest. However, none are federally listed as threatened and endangered within the project area (NMFS 2017). Candidate species are treated as Forest Service sensitive species. No federally listed amphibian species are known to occur in the project area.

Aquatic Habitat

Aquatic habitat in the project ranges from highly productive floodplain channels to less productive high gradient upper valley channels (see Hydrology report for information on channel types). Productive channels throughout the project area provide quality seasonal spawning and year-round rearing habitat for fish species present.

Environmental Effects

Effects of Weeds on Aquatic Ecosystems

Weeds found growing adjacent to or within aquatic influence areas can invade, occupy, and dominate riparian areas and indirectly impact aquatic ecosystems and fish habitat. Weeds can change stand structure and alter future inputs of wood and leaves that provide the basic foundation of the aquatic ecosystem food webs. Native vegetation growth may change as a result of infestation, and the type and quality of litter fall, and quality of organic matter may decline, which can alter or degrade habitat for aquatic organisms.

The impacts of weeds on the environment can last decades, while the impacts of treatment tend to be short term (one year or less). Passive and active restoration would accelerate native vegetative recovery in treated sites.

Effects from Manual and Mechanical Treatments

Manual and mechanical weed treatments occurring near streams and wetlands pose risk of disturbing the aquatic ecosystem by increases in sedimentation. All action alternatives allow hand pulling, clipping, clipping and pulling, mowing, cutting, brush hog, raking, trimming, weed eating, girdling, and tarp/solarizing (control measures for weed species section in the EA) which may result in minor, short term disturbances to fish and other aquatic organisms.

Sediment and Turbidity

Manual and mechanical treatments could lead to localized sedimentation and turbidity to fish habitat because of trampling and soil sloughing due to stepping on banks and removal of weed roots. The amount of localized sediments and turbidity would be negligible because weed populations along streams on the Admiralty National Monument, Juneau, Hoonah, Sitka and Yakutat Ranger Districts are not extensive enough (82 total acres for Class I and II streams across the 8.3 million acre project area) to result in significant sedimentation and turbidity. Additionally, treatment areas within the RMAs of Class I and II streams could be as far away as 100 to 140 feet from the bankfull width of the streams depending on process group of the stream. Treatments to infestations at these distances are not expected to cause sediment to reach the stream. Erosion control measures would be applied in areas where vegetation removals occur which further minimize adverse effects from sediment and turbidity. In the long-term, effective weed treatment and restoration of treated sites would improve the function of riparian areas and lead to improved fish habitat conditions.

Temperature

Removal of weed populations offering shade may increase stream temperature but a significant amount of vegetation would need to be removed to have this effect. Weed species such as reed canary grass and the others shown in Appendix A that would remove vegetation directly adjacent to streams are not known to provide shade for streams so are not expected to affect stream temperature. Additionally, the amount of vegetation to be removed is not enough to measurably affect stream temperature.

Direct Mortality due to Trampling

People working in water have the potential to impact fish by stepping on salmon spawning beds (redds) and disturbing spawning fish. The likelihood of these impacts depends on species present, life stage, number of people and the amount of time spent in the water. Reed canary grass infestations occur along creek banks and up to water’s edge, so people conducting treatments will generally be on the banks above the edge of water. If any manual treatments require working in the water, fish-timing windows would be followed to reduce potential impact to salmonid spawning habitat.

Early Detection-Rapid Response (EDDR)

Effects from future treatments under EDRR would be the same as those listed above. Adherence to PDFs would identify and mitigate any potential effects from manual and mechanical treatments through site-specific design considerations.

Effects of Herbicides in Aquatic Ecosystems

Herbicide treatment techniques include spot spraying for small patches or individual target plants, hand/selective methods to treat individual target plants, and broadcast spraying along roads, around rock pits, and spraying alongside stream channels lined with reed canary grass. This can include wicking, wiping, and other stem and leaf application, basal bark, stem injection, cut-stump and broadcast spraying. See *Control measures for weed species* section in the EA for more information on treatment techniques. In hand based application of herbicides, risk of contamination is reduced because application occurs slowly and is highly localized to target plants. The majority of herbicide would be absorbed into the plant with hand and spot applications. Only the recommended application rates prescribed by the formulation labels will be used.

Herbicide treatments along streams and roadside ditches may result in herbicide reaching water bodies through drift, runoff, and/or leaching. The movement, persistence, and fate of an herbicide in the environment determine the likelihood and the nature of the exposure fish and other aquatic organisms may receive. The primary determinants of exposure of herbicide to fish are herbicide properties, application rate, extent of application, application timing, precipitation amount and timing, and proximity to habitat (NMFS 2007).

Herbicides can alter the structure and biological processes of both terrestrial and aquatic ecosystems; these effects may have more profound influences on communities of fish and other aquatic organisms than direct lethal or sublethal toxic effects (Norris et al. 1991). Stream and lake sediments may be contaminated with herbicides by deposition of soils carrying adsorbed herbicides from the land or by adsorption of herbicides from the water. Reductions in cover, shade, and sources of food from riparian vegetation could result from herbicide deposition in a streamside zone (ibid).

Herbicides have been shown to affect aquatic ecosystem components. However, concentrations of herbicides coming in contact with water following land-based treatments are unlikely to be great enough to cause such changes. While the herbicides considered for use in this project kill aquatic plants, aquatic habitats and the food chain would not be adversely impacted because:

- The amount of herbicide that could be delivered is relatively low in comparison with levels of concern.
- The duration to which any non-target organism (including aquatic plants) would be exposed is very short-lived and impacts to aquatic organisms would be localized.

Active Ingredients in Herbicides to Aquatic Organisms

The primary information evaluated in this analysis is based on laboratory and field studies of herbicide toxicity, exposure, and environmental fate to estimate the risk of adverse effects to aquatic organisms. Formal risk assessments were done by Syracuse Environmental Research Associates, Inc. (SERA) using peer-reviewed articles from the available scientific literature and current Environmental Protection Agency (EPA) documents.

This analysis does not consider the effects of herbicides by fish species; instead, the most sensitive effect from the most sensitive species tested under scenarios that duplicate broadcast spray in an agricultural setting was used to determine the toxicity indices for each herbicide from SERA risk assessments (SERA 2004, 2007b, 2010, 2011a, 2011b; Bautista 2017). Quantitative estimates of dose from each exposure scenario were compared to the corresponding toxicity index to determine the potential for adverse effect. Doses below the toxicity indices resulted in negligible effects. Table 2 lists the toxicity indices for fish used for this project. Physiological responses from exposure to herbicides proposed for use are probably similar between salmon and rainbow trout, a common test species used in laboratory analysis. Values in bold are the values used to assess risk to fish from acute exposures of various herbicide concentrations.

Table 2. Toxicity indices* for salmonids (SERA 2004, 2007b, 2010, 2011a, and 2011b).

Herbicide	Duration	Endpoint	Dose	Species	Effect Noted at LOAEL
Aminopyralid	Acute	NOEC	50 mg/L	Rainbow Trout	Partial loss of equilibrium at 100 mg/L
	Chronic	NOEC	1.36 mg/L	Fathead Minnow	Reductions in fry weight, length, larval survival, and % normal larvae at 2.44 mg/L
Glyphosate (no surfactant)	Acute	NOEC	**0.1 mg/L**	Juvenile Coho Salmon	Impaired olfaction at 1.0 mg/L from Tierney et al. (2006)
	Chronic	NOEC	2.57 mg/L[1]	Rainbow Trout	Life-cycle study in minnows; LOAEL not given
Imazapyr	Acute	NOEC	**5 mg/L** (1/20th LC_{50})	trout, catfish, Bluegill	LC_{50} at 110-180 mg/L for North American species
	Chronic	NOEC	43.1 mg/L	Rainbow Trout	"nearly significant" effects on early life stages at 92.4 mg/L
Metsulfuron methyl	Acute	NOEC	**10 mg/L**	Rainbow Trout	LC_{50} at > 1000 mg/L
	Chronic	NOEC	4.5 mg/L	Rainbow Trout	No LC_{50} was calculated. Small but significant decrease in survival at concentrations >8 mg/L.

* Indices represent the most sensitive endpoint from the most sensitive species for which adequate data are available. Numbers in **bold** indicate the toxicity index used in calculating the hazard quotient for exposures to fish. Generally, the lowest toxicity index available for the species most sensitive to effects was used. Measured chronic data (NOEC) was used when they were lower than 1/20th of an acute LC_{50} because they account for at least some sublethal effects, and doses that are protective in chronic exposures are more certain to be protective in acute exposures.

[1] Estimated from minnow chronic NOEC using the relative potency factor method (SERA 2011b).

Acute Exposures

Acute exposure to an herbicide is generally associated with an accidental spill or application rate beyond label recommendations. Risks to aquatic organisms such as fish, amphibians, invertebrates, algae, or aquatic macrophytes can vary depending on the magnitude (dose and duration) of the exposure. Acute exposures are generally 24 hours for fish (SERA 2007a). With application of any of the aquatic formulations of glyphosate and imazapyr and through the use of licensed applicators and PDFs, acute exposures resulting in an LOC for aquatic organisms are not expected. However, accidental acute exposures due to unintended spills of herbicide in any aquatic environment have markedly higher levels of risk to aquatic organisms.

Chronic Exposures

Chronic exposure to an herbicide is generally associated with repeated treatments over time. Risk to aquatic organisms such as fish, amphibians, invertebrates, algae, or aquatic macrophytes can vary depending on the magnitude (dose and duration) of the exposure. Chronic exposures are generated by continuous exposure for 96 hours, up to and including complete lifecycle studies, depending on chemicals (SERA 2007a). Chronic exposure to fish is not expected to occur with this project because herbicides will typically be applied once a year on average. Also, herbicides proposed for use are metabolized and excreted faster than they can accumulate in the bodies of aquatic animals, or are used at such low application rates and in a selective manner, that overexposure is unlikely.

Table 3. Summary of Herbicide Aquatic Risk Assessment (SERA 2004, 2007b, 2011a, 2011b; Bautista 2017)

Herbicide	Aquatic Risks
Aminopyralid (e.g. Milestone)	There were no exceedences for aminopyralid for any of the aquatic groups. Aminopyralid is considered to be of exceptionally low toxicity to invertebrates and vertebrates including fish and amphibians.
Glyphosate (e.g. AquaPro®, Rodeo®, Roundup Custom®, Aqua Neat®)	Only aquatic formulations of glyphosate would be used. Toxicity concentrations and typical and upper end of normal applications would have negligible impact on fish, but have an increased chance of negatively affecting sensitive macrophyte and algae.
Imazapyr (e.g. Habitat®)	Exposure to fish, aquatic plants and algae are below levels of concern; potential risk to aquatic macrophytes and zooplankton at all application rates. Aquatic phase amphibians assumed to be as sensitive as fish.
Metsulfuron methyl (e.g. Escort XP®)	Exposure to fish is below levels of concern. Amphibians assumed to be as sensitive as fish. Aquatic macrophytes are considered to be the most sensitive species at all concentration rates.

Proximity to Waterbodies

The proposed application limitations result from worst-case scenarios analyzed in the SERA risk assessments. Aminopyralid and Metsulfuron methyl can be applied with spot-spray and hand/selective methods up to the mean high tide line during low/outgoing tides. Glyphosate and Imazapyr may be applied using any application method (spot spray, hand or broadcast) up to and within the water column for emergent vegetation. Using application rates identified on the product label to control target species, as well as conscientiously following applicable PDFs will limit adverse impact to aquatic organisms.

Sub-lethal Effects

In the SERA risk assessment, the term "sub-lethal" is intended to designate effects that may impact reproduction, behavior, or the ability to respond to other stressors. For chronic exposures to glyphosate, the most relevant study remains the life cycle toxicity studies done in fathead minnow. As summarized in SERA (2011b), no effect on mortality or reproduction was observed at a concentration of 25.7 mg/L using pure technical grade glyphosate (without surfactants or adjuvants). It is important to note that the NOEC from this full life-cycle toxicity study not only indicates a lack of mortality but also indicates that the fish were able to reproduce normally. The life cycle NOEC of 25.7 mg/L was used as the most appropriate basis for risk characterization in the SERA 2011 risk assessment.

Tierney et al. (2006) researched the ability of glyphosate to impair salmonid parr olfactory function, critical to imprinting and return migration. The investigators found that at a glyphosate concentration (glyphosate acid of 99% purity) of 0.1 mg/L the changes in the salmon electro-olfactogram (EOG) during a 30 minute exposure and 60 minute recovery period did not differ from the control. However, other glyphosate concentrations, ranging from 1 mg/L to 100 mg/L, showed significant and acute neurophysiological effects through the impairment of olfaction. The study documented a loss of 36% of salmonid EOG after 30 minutes of exposure to 1 mg/L of glyphosate. As shown in the SERA reports, under all typical applications where the peak EEC could reach a maximum of 0.66 mg/L, this is below the level of concern that careful glyphosate use would adversely affect salmon olfaction. This study represents the best available science reporting on the adverse effects of glyphosate, primarily as it provides direct evidence of potential effects on a Tongass Management Indicator Species, coho salmon, instead of using rainbow trout or any other minnow as a proxy for impact.

Off-site Drift

Drift is a likely vector for herbicides coming in contact with water from riparian area, or non-target emergent vegetation treatment sites. The potential for drift varies with the herbicide application method. Drift is commonly associated with broadcast treatments in an agricultural setting. For forestry applications, a typical backpack broadcast spraying with the nozzle less than one meter off the ground would limit extent of unintended drift contamination. Spot and hand/select application methods can reduce the potential for drift into aquatic environments.

Vegetation interception and implementation of PDFs and BMPs will reduce adverse impacts. Given these parameters, minimal impact to aquatic species is expected from potential off-site drift.

Runoff and Percolation

Herbicide can move from the treatment location into adjacent areas through runoff. Some runoff can enter streams either through road or slope drainage. This is dependent on the behavior of a particular herbicide in soils. Herbicide persistence, degradation, and mobility in the soil are considered and those properties will directly influence the possibility of herbicide residues leaching into groundwater and surface soils. Roadside ditches can act as herbicide delivery routes to streams during high rainfalls or as settling ponds following rainfall events.

Both runoff and percolation are considered in estimating ambient environmental water contamination. However, for assessing off-site soil contamination, only runoff is considered. This approach is reasonable because the primary concern is how runoff can contaminate the off-site soil surface and could potentially impact non-target plants. Percolation, on the other hand, represents the amount of the herbicide that is transported below the root zone and thus may impact water quality but should not affect off-site vegetation. Glyphosate is tightly bound to soil and the presence of organic matter in the soil will limit the amount of glyphosate that is transported away from target areas to streams. Imazapyr is moderately mobile in soils and is not as tightly bound as glyphosate (see Soils report for more information). The presence of organic matter and lower pH increases absorption and limits mobility of imazapyr. Aminopyralid has a moderate persistence in soil and a moderate potential to leach through soils and contaminate groundwater (see Soils report for more information). No adverse effects are expected from runoff or percolation of aminopyralid because of its low toxicity to invertebrates and vertebrates. Metsulfuron methyl is highly water soluble, and is therefore susceptible to rainfall runoff and residue leaching, particularly through clay soils due to their low adsorption with this chemical. As such, a higher risk of off-site movement through runoff is assumed when using this herbicide in clay soils. Due to the low occurrences of documented weeds along streams and the use of the lowest impact application method, it is expected that actual treatments of aminopyralid, glyphosate, imazapyr, and metsulfuron methyl will rarely result in herbicide concentrations that exceed a level of concern for aquatic organisms. Interception by organic matter on the forest floor and application of required PDFs will minimize any potential adverse effects from runoff.

Emergent Vegetation Treatments

Hand/selective and spot-spray applications of aquatic formulations of glyphosate and imazapyr would be permitted over water for purposes of treating emergent vegetation.

Treatment of emergent vegetation is the most likely activity to result in salmon or amphibian exposure to herbicide. Exposure from application near stream channels can occur from overspray (spray covering areas beyond target plant), foliar rinse by rainfall, erosion, leaching, and site inundation. There may be some acute (temporary) exposure from spot-spray applications coming in contact with water as a result of treating emergent vegetation both along the margins and for any invasive plants in standing or flowing water. Negligible effects are expected from potential exposure to imazapyr due to its low toxicity to fish, amphibians, and invertebrates. Individual salmon could suffer short-term impairment of essential behaviors associated with glyphosate exposure from emergent vegetation treatments but this is unlikely to occur due to the limited number of infestations in riparian areas and the small amount of herbicides used, and the legal application rate will be far below the toxicity level for lethal effects to fish and other aquatic organisms. Also, most applications would typically involve a single treatment per year. For this project, only aquatic formulas and non-POEA surfactants would be used in aquatic environments. Following PDFs and BMPs will reduce impact to aquatic organisms when treating emergent vegetation.

Treatment of Dry Intermittent Channels and Ditches

Roadside ditches can act as extensions of the stream network where there is enough depth and flow in the ditch to deliver water and sediments. Herbicides applied within dry roadside ditches and intermittent stream channels can be delivered to fish-bearing streams if the herbicide application is followed by a rainfall event. Rainfall can mobilize the herbicide primarily by leaching, dissolving directly into ditch or stream channel flow, and soil erosion. The most significant exposure locations for fish are at or near confluences with perennial streams.

Aminopyralid and metsulfuron methyl can be utilized within dry ditches when rainfall is not imminent. Based on the information presented above, it is reasonable to assume that salmon or other aquatic organisms may be briefly exposed to glyphosate if a rainfall event occurs shortly after an application. No adverse effects are expected from exposure to fish of aquatic versions of imazapyr due to its low toxicity to fish. Limitations in the use of aminopyralid and metsulfuron methyl reduces potential contact to aquatic organisms. To be exposed, individual salmon would need to be near the confluence where a ditch or intermittent stream channel is located when the “first flush” event occurs. The concentration of herbicides would decrease rapidly downstream because of dilution and interactions with physical and biological properties of the stream system (Norris et al. 1991). Actual exposure concentrations and durations at or near confluences with perennial streams will depend on a variety of factors, including the extent of the herbicide application within the ditch/intermittent stream, application rate, extent of riparian applications, and rainfall timing, intensity, and amount. Although it is possible for roadside and intermittent stream herbicide applications to exceed the toxicity indices for fish, algae, macrophytes and non-targeted aquatic plants, it is unlikely the actual applications will result in herbicide concentrations that exceed a level of concern for aquatic organisms. Implementation of PDFs such as checking weather forecasts prior to any treatment, application methods near shorelines and riparian vegetation, and proper selection of herbicides will limit impact to aquatic organisms.

Effects to Individuals

Any toxicological effects of the proposed action on individual salmon are likely to be from sub-lethal exposures to aquatic formulations of glyphosate. No direct effects to fish are expected from exposure to aminopyralid, metsulfuron methyl, or aquatic versions of imazapyr. Tierney et al. (2006) found that short-term (30 minutes) exposures to glyphosate concentrations ranging from 1 mg/L to 100 mg/L, showed significant neurophysiological affects through the impairment of olfaction in juvenile coho salmon. In the environment, impaired olfaction may alter survivorship, because essential behaviors such as alarm and avoidance reactions are linked to olfaction in salmonids (Tierney et al. 2006, Rehnberg et al. 1985).

Young-of-year fry and juvenile salmonids inhabit small streams, stream margins, and side channels that provide cover and prey which can overlap with documented emergent weed populations. If exposure were to occur, fry and juveniles are the life stages most likely to be susceptible to higher concentrations of herbicide because they tend to concentrate in slower waters alongside margins and in backwater habitats where dilution would not happen as readily. Salmon in mainstems of rivers (spawning, foraging, or out-migrating) are not likely to be exposed because these river's large flows will quickly dilute any herbicides to non-detectable concentrations. Smaller streams do not have as much flow and may not dilute herbicides as rapidly. The number of adult salmon potentially exposed is expected to be low, and limited to the scale of individual treatment sites. Adverse effects to juvenile salmon such as increased respiration, reduced feeding success, and subtle behavioral changes that can increase predation risk to individuals may occur. Specifically, adverse effects from glyphosate such as diminished olfactory capacity may occur. However, the duration of these effects is expected to be short-term (minutes to hours), and the likelihood that these effects would actually increase mortality rates due to predation is low due to the short duration of the effects. Potential exposures to herbicides would be brief (minutes to hours), and water quality is expected to return to background levels within minutes to hours.

Herbicides proposed for use by the Admiralty National Monument, Juneau, Hoonah, Sitka and Yakutat Ranger Districts are not expected to reach streams in concentrations that would negatively affect salmonids, or in sufficient quantity to degrade water quality beyond treatment site locations. SERA reports document concentrations of herbicide with potential to harm, or otherwise alter normal behaviors. At typical application rates, the hazard quotient for all herbicides is less than one, demonstrating a low risk of any adverse response to individual fish. At the highest application rates for all herbicides proposed, acute exposures to macrophytes and algae are expected to have a higher risk of negatively affecting these species. However, only imazapyr and glyphosate will be used in or near the aquatic habitat. In addition, a HQ slightly higher than 1 exists for sensitive fish under an acute exposure for Imazapyr. For glyphosate, a HQ of 288 for sensitive fish under an acute exposure (accidental spill) scenario exists, meaning the risk to fish from glyphosate may be higher. It is highly unlikely that an accidental spill of glyphosate (or any other chemical) will occur given the project design features (e.g. herbicide spill and prevention plan) for this project. As such, the risk of negative effects to fish are negligible because of the unlikely event that a spill will take place.

Trampling of banks could introduce minor amounts of sediment into adjoining waters as a result of herbicide treatments alongside streams. The potential for adverse effects as a result of sedimentation of gravels containing eggs or used for spawning is low and unlikely to occur due to the limited amount of infestations in riparian areas and soil disturbance associated with manual weed treatments. The risk of disturbing or displacing spawning salmon or damaging salmon redds is considered negligible due to the PDF to avoid walking in the stream when adults or eggs are present.

Indirect effects to salmon via the food web are expected to be insignificant due to limited exposure of invertebrates to toxic levels of herbicides. The risk assessments indicated use of aquatic imazapyr and metsulfuron methyl may result in localized loss of aquatic macrophytes and/or zooplankton at the scale of an individual treatment site. Macrophytes provide food for aquatic invertebrates. These invertebrates in turn provide food for rearing juvenile salmon. Consequently, adverse effects on aquatic macrophyte production may cause intermittent reductions in availability of forage for juvenile salmon. Due to the limited use of herbicides within and near aquatic habitats, localized losses of aquatic or riparian plants to measurably affect salmon prey populations are not expected.

In summary, the probability of exposure of individual salmon to toxic levels of glyphosate is very low. The duration of exposure is expected to be brief (hours), and the effects of the exposure likely would not cause impairment of normal behaviors such as olfaction, respiration, and predator avoidance. The likelihood of meeting or exceeding levels of concern for fish is extremely low because herbicide use within and to water's edge is restricted to only aquatic approved formulas, and PDFs will be followed such as monitoring weather forecasts prior to herbicide application.

Adjuvants

Herbicides generally need to be applied with an adjuvant, compounds added to the herbicide formulation to improve its performance. They can either enhance the activity of an herbicide's active ingredient (activator adjuvant) or offset any problems associated with its application (special purpose or utility modifiers).

Surfactants are one type of adjuvant that makes the herbicide more effective by increasing absorption into the plant. Surfactants may also improve an herbicide's efficiency so that the concentration or total amount of herbicide required to achieve a given effect is reduced, sometimes as much as five or ten-fold (Tu et al. 2001). In this way, adding an appropriate surfactant can decrease the amount of herbicide applied and lower total costs for weed control (ibid). In some cases, the herbicide would already have the surfactant included, but in other cases, it would be necessary to add one.

Adjuvants are not under the same registration guidelines as pesticides, and the US EPA does not register or approve the labeling of adjuvants. The State of Alaska DEC also does not have an approved adjuvant list. This project references the adjuvants approved for aquatic use in the State of Washington. See link: http://www.ecy.wa.gov/programs/wq/pesticides/regpesticides.html

This project will use only low-risk aquatically approved surfactants such as Agri-Dex®, Class Act® NG®, or Competitor®.

Many of the inert ingredients in adjuvants, compounds intentionally added to the formulation to facilitate its handling, stability or mixing, are proprietary in nature and also have not been tested on laboratory species. However, confidential business information (i.e., the identity of proprietary ingredients) was used in the preparation of the herbicide risk assessments and adjuvants were considered in the overall effects reported for this project.

Impurities are inadvertent contaminants in the herbicide, usually present as a result of the manufacturing process. The risk assessments also describe these and their risks.

Other adjuvants include defoamers and colorants. Deformers are used to reduce the foaming that might occur during agitation of the spray mixture. Colorants can be added to herbicide solutions to enable spray crews to see where they have sprayed after initial evaporation of the solution.

No adverse effects are expected from the use of adjuvants due to the limited area of infestations known in riparian areas and PDFs designed for the project to minimize any effects from herbicide reaching water.

Water Contamination from an Accidental Spill

An herbicide transportation and handling plan is a project requirement which would address spill prevention and containment. Extensive monitoring of herbicide application using similar treatment methods has occurred over the last few years in Northwestern Oregon and Western Washington where no accidental spills have been reported. All personnel applying the herbicides will be trained and supervised by licensed professionals. With similar treatment restrictions and constraints for this proposed project, the risk of an accidental spill under the proposed action is considered to be extremely low. If a spill were to occur, the maximum amount of herbicide would be whatever could be present in a backpack sprayer (i.e. 1-5 gallons). SERA reports adjusted to account for these accurate volumes document the real-world impact from any accidental spill on aquatic organisms. Hazard quotients for all herbicides rise to levels where adverse effects are possible to aquatic organisms in the event of an accidental spill. PDFs would reduce the potential for spills to occur, and if an accident were to occur, minimizes the magnitude and intensity of impacts.

EDRR and response to future infestations

Early detection-rapid response would have similar effects as those discussed above for currently undocumented infestations that may be detected in the future. It is assumed that new infestations will be similar to current infestations. It is also assumed that undocumented infestations will respond with similar results within the same site type using the same treatment methods analyzed in this document. While the precise location and timing of future treatments may be unknown, PDFs intended to minimize or eliminate adverse effects to aquatic organisms will be applied to all treatment sites.

Overall, the quantitative estimate of risk to aquatic species accounts for the properties of the three herbicides, the susceptibility of the species to chemicals, and local conditions. These factors were used to develop additional levels of caution in our use of these chemicals through implementation of project design features (see PDFs) which further reduces the risk of exposure to levels well below the thresholds of concern.

Effects Common to all Action Alternatives

Effects of Early Detection and Rapid Response

To provide the flexibility to treat new infestations, all alternatives include an EDRR management strategy where new infestations would be treated using the range of methods described in this section. It is assumed that new infestations would be similar (in size, species, and site type location) to current infestations. If known or new infestations require treatments outside the scope of the project, or if PDFs cannot be applied without a significant loss of effectiveness, further analysis would be required. EDRR is considered the most efficient method for controlling the spread of weeds in terms of time and money (USDA Forest Service 2013) and includes some level of herbicide use in meeting this strategy.

<u>Direct, Indirect and Cumulative Effects by Alternative</u>

The alternatives vary as to the degree of risk to aquatic organisms from herbicide and non-herbicide treatments. All action alternatives minimize or avoid adverse effects to some degree. None of the alternatives would likely result in direct mortality to fish or measurable, observable impacts.

Alternative 1 (No Action)

Direct and Indirect Effects

Under the No-Action Alternative, ongoing invasive plant treatments will continue as part of the annual district program of work identified through the out-year project prioritization process and in adherence to Tongass N.F. program priorities. Ongoing treatment activities include manual and mechanical treatments of high priority weed infestations throughout the districts as well as a minor amount (less than 4 acres per year) of chemical treatments at administrative and recreation sites (36 CFR220.6). Manual methods include hand pulling, digging, clipping, and tarping. Mechanical methods include mowing or weed-eating.

This alternative necessitates a control or containment strategy rather than eradication for infestations that are difficult to treat using manual or mechanical methods. If no activities occur, weed populations will continue to grow and spread within riparian areas of the Juneau, Hoonah, Sitka, Yakutat Ranger Districts and Admiralty National Monument. If weeds continue to grow they can out-compete native riparian plant species, reducing the productivity of these important areas. Overall there will be a negative impact if no action is taken.

Cumulative Effects

Cumulative effects in the project area are not expected to change as a result of this alternative. Impacts of weeds are currently negligible in most locations due to the limited area collectively occupied by weeds. Impacts of weeds in some high use areas, however, are expected to increase over the long-term as the area of weed infestation and influence on aquatic systems increases.

Alternative 2 (Proposed Action) (Proposed

The proposed action allow the use of manual, mechanical, and herbicidal treatment methods to reduce, contain, or eliminate populations of weeds. An estimate of less than 100 acres will be treated per year under this proposed action.

Herbicide Application Rates and Proximity to Water

Aminopyralid

A typical application rate for aminopyralid is 0.078 lbs a.e. (acid equivalent)/acre. Peak environmental exposure concentrations for fish are 0.0078 mg/L. For reference, the no-observed-effect-concentration (NOEC) for fish is 50 mg/L (Bautista 2017). The NOEC is the exposure level at which there are no biological effects observed. The label for a brand of aminopyralid (Milestone®) prohibits the use of this herbicide where surface water is present, therefore will only be applied up to the edge of perennial and wet intermittent streams, wet ditches, wetlands, saturated soils, lake and ponds (Table 2) when hand or spot spraying. Broadcast applications will require a 100 foot buffer around water to protect riparian vegetation. This buffer combined with the exceptionally low toxicity of this herbicide to aquatic organisms and the use of ground-based application methods are expected to minimize any effect of this herbicide on aquatic resources.

Glyphosate

A typical glyphosate application rate is 2 lbs a.e./acre, with most applications using rates ranging between 0.5 to 2 lbs a.e./acre (SERA 2011). Peak environmental exposure concentrations for fish at an application rate of 2 lbs a.e./acre are 0.02 mg/L. For reference, the NOEC for fish is 0.5 mg/L (Bautista

2017). At this application rate, the central HQ to sensitive fish for non-accidental acute exposure is 0.000003. The use of less toxic formulations of glyphosate near bodies of water where salmonids may occur is proposed and is especially important for treating emergent weeds such as reed canary grass. Spot-spray, and hand/select applications will be allowed to water's edge and in some cases directly over water for purposes of treating emergent plants. Glyphosate can be used up to and beyond the mean high tide line in the marine environment with both application methods. Broadcast applications will require a 100 foot buffer around water to protect riparian vegetation.

Imazapyr

A typical application rate for imazapyr is 0.45 lbs a.e./acre. Peak environmental exposure concentrations for fish at this rate are 0.009 mg/L. For reference, the NOEC for fish is 10.4 mg/L (Bautista 2017). Spot-spray, and hand/select methods will be allowed over water when using aquatic formulations of imazapyr where emergent invasive species have encroached into stream, pond and/or lake margins. Broadcast applications will require a 100 foot buffer around water to protect riparian vegetation. Imazapyr can be used up to and beyond the mean high tide line in the marine environment with both application methods.

Metsulfuron Methyl

The typical application rate for metsulfuron methyl is 0.03 lbs a.e./acre. Peak environmental exposure concentrations for fish at this rate are 0.0003 mg/L. For reference, the NOEC for fish is 10 mg/L (Bautista 2017). A 100 foot buffer will be applied for broadcast spraying near perennial and wet intermittent streams, wet ditches, wetlands, and high water table areas including high tides, streams and ponds.

Direct and Indirect Effects

Alternative 2 proposes the most cautious application of herbicides to control weed populations with the potential for adverse effect on aquatic organisms. All types of herbicide application methods sought for use within 100 feet of any stream, lake, or pond will be specifically formulated for use in aquatic environments. No broadcast spraying will be allowed within 100 feet of any exposed waterbody which drastically decreases the risk of any chemical drift negatively impacting aquatic organisms.

Manual and mechanical treatments could lead to localized sedimentation and turbidity to fish habitat because of vegetation trampling and soil sloughing due to stepping on banks and removal of weed roots. The amount of localized sediments and turbidity would be negligible because weed populations along streams and near estuaries in Admiralty National Monument and the Hoonah, Juneau, Sitka and Yakutat Ranger Districts are not extensive enough to result in treatments causing significant effects. Effective weed treatment and restoration of treated sites would improve the function of riparian areas and lead to improved fish habitat conditions.

Removal of weed populations offering shade could increase water temperature, but a significant amount of vegetation would need to be removed to have this effect. None of the known target weed infestations occurring near streams are known to offer shade and the amount of vegetation to be removed at these locations is not large enough to measurably affect stream temperature.

People working in water have the potential to impact fish by stepping on salmon spawning beds (redds) and disturbing spawning fish. Treatments would avoid impacts to redds or spawning fish because activities would be planned and scheduled to avoid disturbance of spawning fish or damage to redds.

Herbicide Effects to Aquatic Organisms

Aminopyralid

At the typical application rates proposed, the NOEC is below that which would likely cause any adverse effects on aquatic organisms.

Glyphosate – Aquatic Formulation

At the typical application rate proposed, the NOAEC is exceeded only for macrophytes, but only to a level that might begin to cause concern with a low hazard quotient of 2. In the instance of accidental acute exposures with a spill of up to 5 gallons, macrophytes and algae are the most susceptible to harm with upper hazard quotients of 11 and 4, respectively. With a hazard quotient of 1.8, sensitive fish slightly exceed the threshold when exposed to similar spills.

Imazapyr – Aquatic Formulation

Toxicity data is not available for amphibians or sensitive invertebrates, but these concentrations are assumed to affect aquatic-phase amphibians similarly to sensitive fish which show no signs of adverse effect, even at the upper concentration range. At the typical application rate proposed, the NOAEC is only exceeded for macrophytes during both non-accidental and accidental acute exposures because those plants are very sensitive to even low concentrations of this herbicide.

Metsulfuron Methyl

Toxicity data is also not available for amphibians, or sensitive invertebrates and macrophytes. For typical applications, only macrophytes display any sensitivity with an upper hazard quotient of 1.9. In cases of accidental acute exposures where 3-5 gallons may be spilled (which is the upper volume limit of possibility), even tolerant macrophytes begin exhibiting adverse effects from those exposure concentrations with hazard quotients of 5 and 43, respectively.

Early Detection-Rapid Response

Effects of treatments each year under EDRR, by definition, would not exceed those predicted for the most ambitious conceivable treatment scenario (less than 100 acres per year). This is because the PDFs do so much to minimize or eliminate the potential for adverse effects. Effects of treatments under EDRR would be sufficiently minimized by the PDFs regardless of when the treatments occurred. If effective treatments of new infestations required methods outside the scope of the project, or if PDFs could not be applied without a significant loss of effectiveness, further analysis would be necessary prior to treatment.

Cumulative Effects

The proposed activity would not contribute to any cumulative adverse effects for aquatic organisms. Currently the Alaska Department of Transportation in the North Zone Districts are not using herbicide treatments along any roads they maintain. No known herbicide treatments are occurring on adjacent lands. Adjacent private land owners could be using herbicide to treat weeds on their property but the scale would be extremely small. The scale of this project is extremely small overall, estimated to be less than 100 acres per year within the 8.3 million acre project area on the North Zone Districts. Other activities that may occur in the project area include timber harvest and road building. The weed management activity when combined with potential future activities such as timber harvest and road building would not contribute to any cumulative adverse effects to aquatic organisms due to lack of herbicide use in these other types of projects, the minimal direct and indirect effects to aquatic organisms, and the inclusion of specific project design features.

Conclusion

Adverse effects of herbicides, manual, and mechanical treatments to aquatic organisms would be minimal due to the low number of infestations occurring within RMAs near Class I and II streams and along shorelines of the project area.

Aminopyralid has an incredibly low toxicity to aquatic organisms and even accidental acute exposures due to unintended spills are not expected to exceed a level of concern where adverse effects will be observable. Glyphosate, imazapyr, and metsulfuron methyl all display some toxicity to macrophytes in cases of accidental spills greater than one gallon, and spills of glyphosate over three gallons may cause adverse effect on sensitive algae.

The typical application rates, which will be the application rate most used in aquatic situations, of metsulfuron methyl and glyphosate display a small degree of risk with upper hazard quotients (HQ) of 1.9 and 2, respectively. However, imazapyr has an increased risk toward macrophytes with central and upper HQs of 3 and 39, respectively. The upper HQ value of 39 documents a potential cause for concern to macrophytes. Imazapyr is the only herbicide with potential to raise concerns relating to any chronic and long term exposures. Sensitive macrophytes have an upper HQ of 18 which highlights the need for consideration on how to mitigate for any longer term effects in the aquatic environment.

Removal of weeds will cause native plant populations to be restored. This is expected to have positive effects on aquatic habitat and improve conditions for all aquatic organisms in the long run. Any increase in sediment from minor ground disturbance would be so small as to be negligible and would not contribute to accumulation of downstream sediment. Effects are expected to be further minimized through the project design features developed to protect aquatic resources.

Compliance with Forest Plan and Other Relevant Laws, Regulations, and Policies

Findings Required by Law

Magnuson-Stevens Fishery Conservation and Management Act

The potential effects of the project on Essential Fish Habitat (EFH) are included in the Fisheries Biological Evaluation and Essential Fish Habitat Assessment report. This discussion includes reference to the Magnuson-Stevens Fisheries Conservation Act that requires the Forest Service to consult with the National Marine Fisheries Service on projects that may adversely affect EFH. It also includes a description of the EFH in the project area, a description of the proposed activities, and a description of the measures that will protect these essential habitats.

The Forest Service’s position is that treating weeds with herbicides at the proposed application rates will have no adverse effect on EFH. Herbicide treatments would be applied in accordance with label regulations, current Forest Plan direction, BMPs, human health and ecological risk assessments (SERA), and applicable PDFs for the Northern Tongass Weed Management Environmental Assessment. Utilizing these resources and guidelines will minimize or eliminate the potential for weed management activities to negatively impact EFH.

Executive Order 12962

Executive Order 12962 requires federal agencies to evaluate the effects of proposed activities on aquatic systems and recreational fisheries. The project minimizes the effects on aquatic systems through project design, application of Standards and Guidelines, all required BMPs, and site-specific mitigation measures. The implementation of weed treatments may result in temporary road closures (24 hours or less) which could limit access to some recreational fishing opportunities by foot or permitted off-highway vehicle. However, most recreational fishing throughout the Tongass occurs by boat in saltwater, and any adverse effects would be minimal.

Federal and State Permits

A Pesticide Use Permit and an Alaska Pollutant Discharge Elimination System (APDES) permit will be obtained from the State of Alaska Department of Environmental Conservation prior to herbicide use.

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Appendix A

Known acres of known weed infestations within RMAs of Class I and II streams by watershed.

Targeted Weeds by Watershed	Class I	Class II
alsike clover		
Bohemia Creek-Frontal Lisianski Strait	0.009945	
False Island-Frontal Peril Strait	0.004973	
Freshwater Bay-Frontal Chatham Strait	0.000995	
Fritz Cove-Frontal Lynn Canal	0.092754	
Game Creek		0.000995
Iris Meadows	0.000995	
Iyouktug Creek	0.000995	
Mendenhall River	0.009945	
Montana Creek	0.029835	
Port Fredrick-Frontal Icy Strait	0.000144	
Shelikof Bay-Frontal Pacific Ocean	0.000999	
Suntaheen Creek	0.000995	
Total	**0.152575**	**0.000995**
annual bluegrass		
190102110501	0.02371	0.039319
Basket Bay-Frontal Chatham Strait	0.016699	
Bohemia Creek-Frontal Lisianski Strait	0.000995	
Corner Creek	0.010092	
Eastern Channel-Frontal Sitka Sound	0.009945	
False Island-Frontal Peril Strait	0.139933	0.005968
Freshwater Bay-Frontal Chatham Strait	0.014628	
Freshwater Creek	0.06056	0.004961
Fritz Cove-Frontal Lynn Canal	0.324465	
Gilmer Bay-Frontal Pacific Ocean		0.009945
Herbert River	0.000044	
Iris Meadows	0.032868	0.024863
Iyouktug Creek	0.008861	0.010199
Kennel Creek	0.000276	0.009945
Kook Creek	0.099927	
Krestof Sound-Frontal Sitka Sound	0.049727	
Mendenhall River	0.076944	
Montana Creek	0.099453	
Pavlof River	0.000995	0.000995
Peterson Creek-Frontal Lynn Canal	0.000995	
Port Fredrick-Frontal Icy Strait	0.004973	
Salmon Creek-Frontal Gastineau Channel	0.049727	0.066487
Sawmill Creek	0.049727	0.009945
Shelikof Bay-Frontal Pacific Ocean	0.009992	0.009945
Sitka Sound-Frontal Pacific Ocean	0.070279	
Sitkoh Bay-Frontal Peril Strait	0.004973	

Sitkoh Creek	0.059671	0.000995
Spasski Creek	0.000995	
Suntaheen Creek	0.00199	0.000995
Tenakee Inlet-Frontal Chatham Strait	0.199855	
Whitestone Harbor-Frontal Icy Strait		0.00199
Total	**1.423299**	**0.196552**
big chickweed		
190102110501	0.020011	0.021418
Bohemia Creek-Frontal Lisianski Strait	0.154738	
Eastern Channel-Frontal Sitka Sound	0.133729	
False Island-Frontal Peril Strait	0.142917	0.004973
Freshwater Bay-Frontal Chatham Strait	0.006374	
Freshwater Creek	0.009238	0.000995
Fritz Cove-Frontal Lynn Canal	0.162008	
Gypsum Creek-Frontal Iyoukeen Cove		0.004973
Iris Meadows	0.005968	0.049727
Kennel Creek	0.000276	
Krestof Sound-Frontal Sitka Sound	0.049727	
Mendenhall River	0.076944	
Montana Creek	0.00199	
Pavlof River	0.000995	0.000995
Peterson Creek-Frontal Lynn Canal	0.102505	
Port Fredrick-Frontal Icy Strait	0.000995	
Salmon Creek-Frontal Gastineau Channel	0.009945	0.009598
Sawmill Creek		0.004973
Sitka Sound-Frontal Pacific Ocean	0.004973	
Sitkoh Bay-Frontal Peril Strait	0.004973	
Sitkoh Creek	0.026855	0.000995
Spasski Creek	0.00199	
Suntaheen Creek	0.004973	
Total	**0.922124**	**0.098647**
bigleaf lupine		
Antlen River	0.037592	
Dangerous River	0.118583	
Lost River	0.00382	
Situk River	0.809288	
Tawah Creek	0.682876	
Upper Ahrnklin River	0.006902	
Total	**1.659061**	
birdeye pearlwort		
190102110501	0.001521	
Eastern Channel-Frontal Sitka Sound	0.018162	
False Island-Frontal Peril Strait	0.005968	
Pavlof River		0.000995

Total	**0.025651**	**0.000995**
bitter dock		
Eastern Channel-Frontal Sitka Sound	0.000995	
Sawmill Creek		0.004973
Total	**0.000995**	**0.004973**
black bindweed		
Whitewater Bay-Frontal Chatham Strait		0.063257
Total		**0.063257**
Bohemian knotweed		
Fritz Cove-Frontal Lynn Canal	0.024863	
Montana Creek	0.009945	
Total	**0.034808**	
brittlestem hempnettle		
Sitka Sound-Frontal Pacific Ocean	0.099927	
Total	**0.099927**	
butter and eggs		
Eastern Channel-Frontal Sitka Sound	0.000995	
Total	**0.000995**	
Canada bluegrass		
Pavlof River	0.009992	
Salmon Creek-Frontal Gastineau Channel	0.009945	
Total	**0.019937**	
Canada thistle		
Young Bay-Frontal Stephens Passage		0.015187
Total		**0.015187**
common chickweed		
False Island-Frontal Peril Strait	0.004973	
Mendenhall River	0.000994	
Peanut Lake-Frontal Chatham Strait	0.281571	0.020137
Peterson Creek-Frontal Lynn Canal	0.007037	
Salmon Creek-Frontal Gastineau Channel		0.036565
Sitka Sound-Frontal Pacific Ocean	0.000995	
Sitkoh Creek	0.004973	
Yakutat Bay-Frontal Gulf of Alaska	1.624046	
Total	**1.924589**	**0.056702**
common comfrey		
Peterson Creek-Frontal Lynn Canal	0.006503	
Total	**0.006503**	
common dandelion		
190102110403		0.055437
190102110501	0.010873	0.006963
Antlen River	0.000459	
Barlow Cove-Frontal Lynn Canal	0.044976	
Berners Bay-Frontal Lynn Canal	0.019098	

Bohemia Creek-Frontal Lisianski Strait	0.009945	
Dangerous River	0.07675	
Eastern Channel-Frontal Sitka Sound	1.157631	
False Island-Frontal Peril Strait	0.014919	0.000995
Freshwater Bay-Frontal Chatham Strait	0.091028	
Freshwater Creek	0.192875	0.004961
Fritz Cove-Frontal Lynn Canal	0.261461	
Game Creek		0.00199
Gartina Creek	0.014918	
Headwaters Skagway River		2.501151
Herbert River	0.008331	
Idaho Inlet-Frontal Icy Strait	0.949898	
Iyouktug Creek	0.014965	0.01194
Kennel Creek	0.539071	0.009945
Kook Creek	0.009992	
Lake Florence		0.553794
Lemesurier Island	0.552637	0.137248
Mendenhall River	0.076944	0.024435
Montana Creek	0.119343	
Pavlof River	0.050958	0.000995
Peanut Lake-Frontal Chatham Strait		0.005549
Peterson Creek-Frontal Lynn Canal	0.321332	
Port Fredrick-Frontal Icy Strait	0.041499	
Salmon Creek-Frontal Gastineau Channel	0.049727	0.036565
Sawmill Creek	0.009945	0.000995
Sister Lake	19.320021	
Sitka Sound-Frontal Pacific Ocean	0.02194	
Sitkoh Bay-Frontal Peril Strait	0.000995	
Sitkoh Creek	0.019891	0.004973
Spasski Creek	0.021895	0.026058
Suntaheen Creek	0.009945	0.005968
Tawah Creek	0.078983	
Tenakee Inlet-Frontal Chatham Strait	0.294199	0.000995
Upper Ahrnklin River	0.000999	
Whitestone Harbor-Frontal Icy Strait		0.009946
Total	**24.408443**	**3.400903**
common gypsyweed		
Neka River	0.04598	
Total	**0.04598**	
common mouse-ear chickweed		
Eastern Channel-Frontal Sitka Sound	0.096427	
Freshwater Bay-Frontal Chatham Strait	0.090033	
Kasnyku Bay-Frontal Chatham Strait	0.058063	
Kennel Creek	0.539071	

Pavlof River	0.049963	
Silver Bay-Frontal Eastern Channel	0.096602	
Total	**0.930159**	
common nipplewort		
False Island-Frontal Peril Strait	0.000995	0.000995
Sitkoh Creek	0.000995	
Total	**0.00199**	**0.000995**
common plantain		
190102110403		0.000995
190102110501	0.152795	0.039319
Antlen River	0.001458	
Bohemia Creek-Frontal Lisianski Strait	0.154738	
Corner Creek	0.062773	
Eastern Channel-Frontal Sitka Sound	0.591947	
False Island-Frontal Peril Strait	0.222555	0.009946
Freshwater Bay-Frontal Chatham Strait	0.019601	
Freshwater Creek	0.003923	0.000995
Fritz Cove-Frontal Lynn Canal	0.324465	
Game Creek		0.000995
Gartina Creek	0.00199	
Iris Meadows	0.097164	
Iyouktug Creek	0.010855	0.02114
Kanalku Bay-Frontal Mitchell Bay	0.608374	
Kennel Creek	0.001626	0.004973
Kook Creek	0.009992	
Krestof Sound-Frontal Sitka Sound	0.004973	
Lake Florence	0.099927	
Lost River	0.00382	
Mendenhall River	0.076944	
Montana Creek	0.119343	
Pavlof River	0.011454	0.010334
Peterson Creek-Frontal Lynn Canal	0.272086	
Port Fredrick-Frontal Icy Strait	0.009945	
Salmon Creek-Frontal Gastineau Channel	0.099453	0.036565
Sawmill Creek		0.049727
Sitka Sound-Frontal Pacific Ocean	0.025888	
Sitkoh Bay-Frontal Peril Strait	0.009945	
Sitkoh Creek	0.09898	0.004973
Spasski Creek	0.005497	0.000995
Suntaheen Creek		0.009946
Tawah Creek	0.05389	
Tenakee Inlet-Frontal Chatham Strait	0.375669	0.000995
Upper Ahrnklin River	0.000999	
Whitestone Harbor-Frontal Icy Strait		0.009946

Total	**3.533069**	**0.201844**
common sheep sorrel		
False Island-Frontal Peril Strait	0.002985	
Freshwater Bay-Frontal Chatham Strait	0.090033	
Kennel Creek	0.539071	
Kook Creek		0.009924
Yakutat Bay-Frontal Gulf of Alaska	1.624046	
Total	**2.256135**	**0.009924**
common tansy		
Freshwater Bay-Frontal Chatham Strait	0.055612	
Kennel Creek	0.618976	
Port Fredrick-Frontal Icy Strait	0.084397	
Total	**0.758985**	
common yarrow		
Antlen River	0.004455	
Tenakee Inlet-Frontal Chatham Strait	0.199855	
Upper Ahrnklin River	0.004904	
Total	**0.20914**	
creeping bentgrass		
190102110501		0.000995
Sitkoh Creek	0.000995	
Tawah Creek	0.006565	
Total	**0.00756**	**0.000995**
creeping buttercup		
Bohemia Creek-Frontal Lisianski Strait	0.009945	
Carlson Creek	0.003956	
Eastern Channel-Frontal Sitka Sound	3.616169	
False Island-Frontal Peril Strait	0.14896	
Freshwater Bay-Frontal Chatham Strait	0.000995	
Freshwater Creek	0.000995	
Fritz Cove-Frontal Lynn Canal	0.324465	
Kennel Creek	0.000276	
Lake Florence	0.099927	
Lemesurier Island	0.114468	
Mendenhall River	0.076944	
Montana Creek	0.139233	
Peterson Creek-Frontal Lynn Canal	0.128988	
Port Fredrick-Frontal Icy Strait	0.020627	
Salmon Creek-Frontal Gastineau Channel	0.099453	0.066487
Sawmill Creek	0.009945	0.049727
Shelikof Bay-Frontal Pacific Ocean		0.004973
Sitka Sound-Frontal Pacific Ocean	0.193158	
Suntaheen Creek	0.000995	
Tenakee Inlet-Frontal Chatham Strait	0.199855	

Whitestone Harbor-Frontal Icy Strait		0.000995
Total	**5.189354**	**0.122182**
disc mayweed		
Iris Meadows	0.000995	
Mendenhall River	0.041766	
Montana Creek	0.01989	
Pavlof River	0.000999	
Port Fredrick-Frontal Icy Strait	0.000995	
Sawmill Creek		0.000995
Tenakee Inlet-Frontal Chatham Strait	0.000999	
Total	**0.065644**	**0.000995**
European mountain ash		
Eastern Channel-Frontal Sitka Sound	0.260513	
Total	**0.260513**	
fall dandelion		
Tawah Creek	0.294672	
Total	**0.294672**	
field mustard		
Gambier Bay-Frontal Stephens Passage		0.000999
Grand Island-Frontal Stephens Passage	2.84358	
Seymour Canal-Frontal Stephens Passage		0.382918
Total	**2.84358**	**0.383917**
field sowthistle		
Barlow Cove-Frontal Lynn Canal	0.04375	
Lemon Creek	0.199854	
Total	**0.243604**	
fowl bluegrass		
190102110501	0.009945	0.014919
False Island-Frontal Peril Strait	0.008953	0.000995
Freshwater Bay-Frontal Chatham Strait	0.005678	
Freshwater Creek	0.004628	0.000995
Gartina Creek	0.005968	
Kennel Creek	0.001626	
Outlet Chuck River	0.469689	
Pavlof River		0.000995
Sawmill Creek	0.000995	0.004973
Sitkoh Bay-Frontal Peril Strait	0.004973	
Sitkoh Creek	0.011936	
Spasski Creek	0.002985	
Whitestone Harbor-Frontal Icy Strait		0.000995
Windham Bay-Frontal Stephens Passage	0.29424	
Total	**0.821616**	**0.023872**
foxtail barley		
Greens Creek	0.003924	

Hawk Inlet-Frontal Chatham Strait	0.120619	0.099455
Salmon Creek-Frontal Gastineau Channel		0.000999
Total	**0.124543**	**0.100454**
Garden strawberry		
Montana Creek	0.009945	
Total	**0.009945**	
Italian ryegrass		
Corner Creek	0.099543	
Peterson Creek-Frontal Lynn Canal	0.029836	
Tenakee Inlet-Frontal Chatham Strait	0.009992	
Total	**0.139371**	
Japanese knotweed		
Deep Cove-Frontal Chatham Strait		0.267808
Eastern Channel-Frontal Sitka Sound	0.278678	
Fritz Cove-Frontal Lynn Canal	0.292207	
Montana Creek	0.099926	
Peterson Creek-Frontal Lynn Canal		0.002738
Port Walter-Frontal Chatham Strait	0.047321	
Salmon Creek-Frontal Gastineau Channel	0.599558	0.52091
Sitka Sound-Frontal Pacific Ocean	0.099927	
Total	**1.417617**	**0.791456**
Kentucky bluegrass		
190102110501	0.009945	0.005968
Bohemia Creek-Frontal Lisianski Strait	0.000995	
Dangerous River	0.007608	
False Island-Frontal Peril Strait	0.110394	
Fritz Cove-Frontal Lynn Canal	0.099453	
Game Creek		0.000635
Kennel Creek	0.001626	
Lake Florence	0.099927	
Mendenhall River	0.009945	
Montana Creek	0.029835	
Port Fredrick-Frontal Icy Strait	0.009945	
Sawmill Creek	0.009945	
Sitkoh Creek	0.009945	
Situk River	0.158709	
Spasski Creek	0.00199	
Suntaheen Creek	0.000995	
Total	**0.561257**	**0.006603**
meadow fescue		
Iyouktug Creek	0.008861	0.060163
Total	**0.008861**	**0.060163**
meadow foxtail		
Iyouktug Creek		0.000995
Total		**0.000995**

meadow hawkweed		
Herbert River	0.109498	
Total	**0.109498**	
narrowleaf hawkweed		
Sitkoh Creek	0.004973	
Total	**0.004973**	
orange hawkweed		
Fritz Cove-Frontal Lynn Canal	0.009945	
Herbert River	0.000044	
Mendenhall River	0.066514	
Total	0.076503	
orchardgrass		
Game Creek		0.003793
Gypsum Creek-Frontal Iyoukeen Cove		0.004973
Kennel Creek	0.001626	
Salmon Creek-Frontal Gastineau Channel	0.099927	
Suntaheen Creek	0.000995	
Upper Ahrnklin River	0.000999	
Young Bay-Frontal Stephens Passage		0.124957
Total	**0.103547**	**0.133723**
oxeye daisy		
Ansley Island-Frontal Icy Strait		0.141295
Basket Bay-Frontal Chatham Strait		0.001408
Eastern Channel-Frontal Sitka Sound	0.000995	
False Island-Frontal Peril Strait	0.000995	
Freshwater Bay-Frontal Chatham Strait	0.094612	
Freshwater Creek	1.171099	0.526148
Fritz Cove-Frontal Lynn Canal	0.049727	
Kennel Creek	1.535711	
Montana Creek	0.004973	
Pavlof River	0.000999	
Peterson Creek-Frontal Lynn Canal	0.009946	
Salmon Creek-Frontal Gastineau Channel		0.035924
Sitka Sound-Frontal Pacific Ocean	0.014593	
Tawah Creek	0.009945	
Windham Bay-Frontal Stephens Passage		0.053148
Total	**2.893595**	**0.757923**
purple foxglove		
Eastern Channel-Frontal Sitka Sound	0.050982	
Lake Anna-Frontal Klag Bay	0.015277	0.006314
Sitka Sound-Frontal Pacific Ocean	0.005998	
Total	**0.072257**	**0.006314**
red clover		
Freshwater Creek		0.000995
Fritz Cove-Frontal Lynn Canal	0.059672	

Gartina Creek	0.000995	
Port Fredrick-Frontal Icy Strait	0.004973	
Suntaheen Creek	0.000995	
Total	**0.066635**	**0.000995**
reed canarygrass		
190102110403		0.125348
190102110501	0.177287	0.261446
Antlen River	0.702345	
Basket Bay-Frontal Chatham Strait	0.016699	0.211793
Bohemia Creek-Frontal Lisianski Strait	0.000274	
Corner Creek	0.162316	
Cowee Creek	0.099927	
Eastern Channel-Frontal Sitka Sound	0.111895	0.018289
False Island-Frontal Peril Strait	0.228447	0.009945
Freshwater Bay-Frontal Chatham Strait	0.256943	
Freshwater Creek	0.697231	0.004961
Fritz Cove-Frontal Lynn Canal	0.102699	
Game Creek		0.248761
Gartina Creek	0.005968	
Gypsum Creek-Frontal Iyoukeen Cove		0.000995
Humpback Creek	0.999273	
Iris Meadows	0.03083	0.050722
Iyouktug Creek	0.138987	0.104024
Kennel Creek	0.128398	0.009945
Kook Creek	0.106496	0.07579
Krestof Sound-Frontal Sitka Sound	0.049727	
Lost River	0.027426	
Mendenhall River	0.041766	
Montana Creek	0.029835	
Pavlof River	0.111334	0.011329
Peterson Creek-Frontal Lynn Canal	0.09615	
Port Fredrick-Frontal Icy Strait	0.082513	
Salmon Creek-Frontal Gastineau Channel		0.463861
Sawmill Creek	0.099927	0.000995
Sitka Sound-Frontal Pacific Ocean	0.398128	
Sitkoh Bay-Frontal Peril Strait	0.016436	0.006798
Sitkoh Creek	0.641722	0.01088
Spasski Bay-Frontal Icy Strait	0.911155	
Spasski Creek	0.025362	0.017677
Suntaheen Creek	0.004973	0.01989
Tawah Creek	0.849651	
Tenakee Inlet-Frontal Chatham Strait	0.199855	0.100359
Upper Ahrnklin River	3.732841	
Whitestone Harbor-Frontal Icy Strait		0.014918
Total	**11.284816**	**1.768726**

shepherd's purse		
Freshwater Bay-Frontal Chatham Strait	0.090033	
Kennel Creek	0.539071	
Peterson Creek-Frontal Lynn Canal	0.009945	
Total	**0.639049**	
slender hairgrass		
190102110403		0.055437
False Island-Frontal Peril Strait	0.005968	
Pavlof River	0.000467	0.009339
Total	**0.006435**	**0.064776**
splitlip hempnettle		
Eliza Harbor-Frontal Frederick Sound	0.153917	
Montana Creek	0.009945	
Total	**0.163862**	
sticky chickweed		
Tawah Creek	0.003325	
Total	**0.003325**	
stinking willie		
Young Bay-Frontal Stephens Passage		0.218544
Total		**0.218544**
suckling clover		
False Island-Frontal Peril Strait	0.165145	
Total	**0.165145**	
sweet clover		
Whitewater Bay-Frontal Chatham Strait		0.053566
Total		**0.053566**
tall buttercup		
Fritz Cove-Frontal Lynn Canal	0.014918	
Peterson Creek-Frontal Lynn Canal	0.030831	
Salmon Creek-Frontal Gastineau Channel	0.000995	
Total	**0.046744**	
tall fescue		
190102110501		0.066853
Basket Bay-Frontal Chatham Strait		0.097315
Bohemia Creek-Frontal Lisianski Strait	0.088997	
Eastern Channel-Frontal Sitka Sound	0.009945	
False Island-Frontal Peril Strait	0.000995	
Freshwater Bay-Frontal Chatham Strait	0.005379	
Freshwater Creek	0.031268	0.004961
Game Creek		0.008766
Gartina Creek	0.005968	
Gypsum Creek-Frontal Iyoukeen Cove		0.099454
Iris Meadows	0.000995	
Iyouktug Creek	0.01094	0.007958
Port Fredrick-Frontal Icy Strait	0.004973	

Sawmill Creek		0.000995
Sitkoh Creek		0.000995
Spasski Creek	0.000995	
Suntaheen Creek	0.004973	0.00199
Tenakee Inlet-Frontal Chatham Strait	0.099927	0.126161
Whitestone Harbor-Frontal Icy Strait		0.000995
Total	**0.265355**	**0.416443**
thymeleaf speedwell		
Antlen River	0.001458	
False Island-Frontal Peril Strait	0.000995	
Tawah Creek	0.004987	
Total	**0.00744**	
timothy		
190102110501	0.01094	0.009483
Corner Creek	0.009993	
False Island-Frontal Peril Strait	0.000995	
Freshwater Bay-Frontal Chatham Strait	0.091028	
Freshwater Creek		0.000995
Fritz Cove-Frontal Lynn Canal	0.000995	
Game Creek		0.000995
Iris Meadows	0.065644	0.059672
Kennel Creek	0.539071	
Montana Creek	0.014918	
Peterson Creek-Frontal Lynn Canal	0.064628	
Port Fredrick-Frontal Icy Strait	0.009945	
Salmon Creek-Frontal Gastineau Channel	0.000995	
Sawmill Creek	0.004973	0.004973
Shelikof Bay-Frontal Pacific Ocean	0.000999	
Sitka Sound-Frontal Pacific Ocean	0.000995	
Sitkoh Creek	0.000995	
Spasski Creek	0.010432	0.000995
Tenakee Inlet-Frontal Chatham Strait	0.199855	
Upper Ahrnklin River	0.000999	
Young Bay-Frontal Stephens Passage		0.140769
Total	**1.0284**	**0.217882**
true forget-me-not		
Fritz Cove-Frontal Lynn Canal	0.117617	
Montana Creek	0.009945	
Peterson Creek-Frontal Lynn Canal	0.03083	
Total	**0.158392**	
unknown		
Peterson Creek-Frontal Lynn Canal	0.000995	
Total	**0.000995**	
western dock		
Slocum Arm-Frontal Pacific Ocean	0.20769	

Tenakee Inlet-Frontal Chatham Strait	0.290224	
Total	**0.497914**	
western pearly everlasting		
Antlen River	0.000999	
Seal Creek	0.010991	
Total	**0.01199**	
white clover		
190102110501	0.000995	0.011472
Antlen River	0.02685	
Bohemia Creek-Frontal Lisianski Strait	0.009945	
Corner Creek	0.000999	
Eastern Channel-Frontal Sitka Sound	0.174804	
Endicott Arm-Frontal Holkham Bay	0.22789	
False Island-Frontal Peril Strait	0.025563	
Freshwater Bay-Frontal Chatham Strait	0.096001	
Freshwater Creek	0.000105	0.000995
Fritz Cove-Frontal Lynn Canal	0.274739	
Gartina Creek	0.005968	
Gypsum Creek-Frontal Iyoukeen Cove		0.009945
Herbert River	0.000044	
Iris Meadows	0.012977	
Iyouktug Creek	0.009856	0.021186
Kennel Creek	0.577659	
Lemesurier Island	0.552637	0.137248
Lost River	0.00382	
Mendenhall River	0.076944	
Montana Creek	0.119343	
Pavlof River	0.009992	
Peterson Creek-Frontal Lynn Canal	0.131338	
Port Fredrick-Frontal Icy Strait	0.009945	
Salmon Creek-Frontal Gastineau Channel	0.009945	0.009598
Sawmill Creek	0.004973	0.004973
Sitka Sound-Frontal Pacific Ocean	0.005998	
Sitkoh Bay-Frontal Peril Strait	0.004973	
Sitkoh Creek	0.007958	0.000995
Spasski Creek	0.005497	0.000995
Suntaheen Creek	0.009945	
Tawah Creek	0.009992	
Tenakee Inlet-Frontal Chatham Strait	0.661864	0.001994
Upper Ahrnklin River	0.02289	
Yakutat Bay-Frontal Gulf of Alaska	1.624046	
Total	**4.716495**	**0.199401**
Grand Total	**72.725941**	**9.380899**

Addendum – Alternative 3

This analysis was updated following the initial draft submitted in September 25, 2018. Alternative 3 was developed in response to several items which necessitated clarification and/or correction following review by experienced practitioners not involved in the original document. This addendum reflects the following changes, updates, and effects between action alternatives:

- Language regarding broadcast treatments in this project was clarified in the text to accurately reflect how this technique is applied.
- Broadcast spray buffers of 100 feet to water were removed in Alternative 3 since these were incompatible with control of reed canarygrass, the primary species of concern in riparian areas. Populations of this plant grow to water's edge and colonize mid-channel bars and other areas within the bankfull margins, altering flow dynamics by stabilizing previously mobile cobble bars and ultimately impacting fish habitat. Targeted broadcast spraying from a backpack is the only effective control method in these environments. Aquatic-based formulations would be used following herbicide label directions.
- The effect of removing these buffers would be negligible since broadcast spray methods in a wildland context are minimally different than spot-spray methods. A backpack sprayer is used in both scenarios, with practitioners employing minimal spray distances and targeting invasive plants with a hand-held wand. Only aquatic-based formulations would be used in these environments.
- The risk of impacting non-target riparian vegetation increases in this alternative.
- The long-term benefit to riparian vegetation and instream fish habitat increases due to a more effective control method for reed canarygrass.
- The application rates of all herbicides analyzed in the SERA risk assessment spreadsheets increased to reflect maximum-allowed label concentrations. Analyzed glyphosate application rates increased from 2 to 8 lb a.e./acre to allow stem-injections in Japanese knotweed populations in the project area. Application rates analyzed in Alternative 2 were insufficient to effectively control these populations. Analyzed imazapyr rates of 0.45 lb a.e./acre in Alternative 2 were increased to 1.5 lb a.e./acre in Alternative 3, with known local populations requiring 1.0 lb a.e./acre to be effective. Similarly, analyzed application rates for aminopyralid increased from 0.078 to 0.11 lb a.e./acre, and metsulfuron methyl increased from 0.03 to 0.15 lb a.e./acre, in Alternatives 2 and 3, respectively. The increased application rates reflect the maximum permissible by label in aquatic environments. This allows more flexibility when responding to control needs which vary by species and label. As such, SERA spreadsheets were updated with the increased application rates in Alternative 3, with the following results:
- Hazard quotients remained well below potential toxicity levels for aminopyralid, given the maximum application rates.
- Hazard quotients associated with maximum application rates of 8 lb a.e./acre proposed for glyphosate exceed potential toxicity levels for sensitive species of fish, invertebrates, macrophytes, and algae, given an acute accidental exposure scenario. Use of the lower application rate proposed in Alternative 2 results in similar potential risk to the same sensitive species given the same scenario.
- Maximum application rates of imazapyr result in hazard quotients exceeding potential toxicity levels for sensitive macrophytes and algae given accidental acute and non-accidental acute exposures.
- Maximum application rates of metsulfuron methyl also result in hazard quotients exceeding potential toxicity levels for macrophytes and algae, given accidental acute exposures (SERA

spreadsheet, project record). Results are the same regardless of whether considering herbicide volumes contained in a typical backpack sprayer or the much higher default spill volumes calculated in the SERA spreadsheet.

- The default SERA spreadsheet determines hazard quotients for accidental acute exposure based on spills corresponding to volumes carried in an industrial agricultural setting. These spill volumes are higher (20-200 gallons) than would be typical with a backpack sprayer; however, spill volumes typical of backpack spray applications (1-5 gallons) still exceeded hazard quotients for macrophytes with use of all herbicides but aminopyralid.
- The risk of negative impacts to sensitive species of fish, invertebrates, macrophytes, and algae, given an acute accidental exposure scenario under maximum application rates, is higher and the overall effect is considered moderate in Alternative 3 compared with Alternative 2.
- The long-term benefit to riparian vegetation and instream fish habitat increases in this alternative because the potential use of maximum application rates can improve the effectiveness of treatments in these environments.
- Conclusion: Herbicide use in Alternative 3 would result in a minor, short-term negative effects to water quality. However, these effects would decline to a negligible level corresponding with rapid reduction in size of infestations and herbicide usage in years following initial herbicide application. Positive, long-term effects on water quality, riparian condition, and ultimately instream fish habitat is expected by efficiently removing weed species and restoring native plant communities. Allowing broadcast spraying to water's edge as well as using the maximum application rates where necessary would result in minor, short-term, localized and potentially adverse impacts on water quality. These effects would increase to moderate for sensitive species of fish, invertebrates, macrophytes, and algae, given an acute accidental exposure due to spill. Proper handling and careful consideration of project design features would minimize the potential for accidental spills. Long-term, the effects of herbicide application are expected to be negligible, localized, and beneficial to water quality and riparian condition.