

Fender's Blue Butterfly Habitat Restoration at Henry Hagg Lake: 2019 Annual Report (Web Version)



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Report for the U.S. Fish and Wildlife Service,
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PREFACE

IAE is a non-profit organization whose mission is conservation of native ecosystems through restoration, research and education. IAE provides services to public and private agencies and individuals through development and communication of information on ecosystems, species, and effective management strategies. Restoration of habitats, with a concentration on rare and invasive species, is a primary focus. IAE conducts its work through partnerships with a diverse group of agencies, organizations and the private sector. IAE aims to link its community with native habitats through education and outreach.



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Cover photographs: Looking south across Henry Hagg Lake from the Lakeside East meadow with Kincaid's lupine (*Lupinus oregonus*) flowering in the foreground. Photo: IAE.

SUGGESTED CITATION

Neill, A. and A. Esterson. 2020. Fender's blue butterfly habitat restoration at Henry Hagg Lake: 2019 Annual Report. Unpublished report for the U.S. Fish and Wildlife Service, Portland, OR. Institute for Applied Ecology. Corvallis, Oregon.

Special Note: This report has been modified from its original format by removing maps and/or appendices that include information on the location of rare and sensitive species

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1. EXECUTIVE SUMMARY

In 2019, the Institute for Applied Ecology (IAE) partnered with the U.S. Fish and Wildlife Service (Service) to help restore habitat at Henry Hagg Lake (Hagg Lake) to aid in the recovery of the endangered Fender's blue butterfly (*Icaricia icarioides fenderi*) and its host plant, the threatened Kincaid's lupine (*Lupinus oreganus*). Through this partnership, IAE provides recommendations for habitat management, executes on-the-ground management actions, manages subcontractors, produces and procures native plant materials, and develops and purchases native seed mixes. Specific accomplishments in 2019 include:

- Completed production and planting of 392 Kincaid's lupine plants in nectar islands 1, 2, 3, and 4.
- Completed Fender's blue butterfly surveys to assess population abundance and habitat quality.
- Collected 0.25 lbs of Kincaid's lupine seed from plants at Hagg Lake.
- Contracted a subcontractor to mow areas of Lakeside East, Lakeside West, and Scoggins Bend to reduce woody encroachment and thatch.
- Removed Douglas-fir (*Pseudotsuga menziesii*) and apple (*Malus domestica*) trees and lower limbs of large Douglas-fir from Lakeside East and West.
- Advised the Service in directing a subcontractor to perform herbicide treatments throughout the project area.
- Hand-pulled a patch of knapweed (*Centaurea* sp.) in Lakeside East and removed from the site.
- Removed small trees, shrubs and lower limbs of large Douglas-fir to create a corridor between Lakeside East and Stepping Stone.
- Grew and planted ~900 plugs of a mix of dwarf checkermallow (*Sidalcea virgata* ssp. *malviflora*), Oregon geranium (*Geranium oregonum*), and toughleaf iris (*Iris tenax*) in nectar islands 1, 2, 3, 4 and 15 and in a corridor between Lakeside East and West.

2. INTRODUCTION

Henry Hagg Lake (Hagg Lake, Figure 1) is a man-made reservoir owned by the Bureau of Reclamation (BOR) and is located five miles southwest of Forest Grove, Oregon in the Scoggins Valley Park, which is managed by Washington County Parks (Parks). The lake provides an opportunity for recreation and water for irrigation, industry, local communities, and flood control in the Tualatin Valley, Oregon. As surrounding communities grow and agricultural production increases, the demand for water rises. Based on these conditions, the BOR has proposed to increase the water level of the lake so that it will continue

to provide adequate resources for the community, agriculture and industry; however, no timeline is in place for implementation of this water level increase.



Figure 1. Location of Fender's blue butterfly (*Icaricia icarioides fenderi*) and Kincaid's lupine (*Lupinus oregonus*) at Henry Hagg Lake .

Located on the northern shore of the lake (Figure 1) is one of the largest populations of the federally endangered Fender's blue butterfly (Figure 2) and its host plant, the federally threatened Kincaid's lupine (Figure 3). When the water level rises there will be substantial loss to these threatened and endangered species (Figure 4). To offset the impacts of the anticipated water level change to both Kincaid's lupine and Fender's blue butterfly, the BOR has provided funding for IAE to work with the Service to restore habitat upslope from the lake. It is hoped that Fender's blue butterfly will passively relocate to the newly restored locations above the proposed flood zone.



Figure 2. Fender's blue butterfly (*Icaricia icarioides fenderi*). (Photos: Peter Moore)

Other threats to Fender's blue butterfly habitat and Kincaid's lupine include direct competition from non-native forbs such as Queen Anne's lace (*Daucus carota*), non-native grasses such as tall oatgrass (*Arrhenatherum elatius*) and tall fescue (*Schedonorus arundinaceus*), and encroachment of woody species into prairie habitat.

Management actions by the Service and IAE over the past several years have led to greater abundances of both the Fender's blue butterfly (Menke 2019) and its host plant, Kincaid's lupine (Menke and Ottombrino 2019). This suggests that ongoing efforts to expand and enhance prairie habitats at Hagg Lake will continue to aid in the recovery of these species. In particular, the mowing to reduce competition, thatch and seed production of non-native grasses and establishment of nectar islands have both improved nectar availability and growing conditions for Kincaid's lupine.



Figure 3. Kincaid's lupine (*Lupinus oreganus*) flowering at Hagg Lake. (Photo: IAE)

3. GOALS AND OBJECTIVES

The goal of this project is to create habitat for the Fender's blue butterfly above the proposed flood line and to passively relocate the Fender's blue butterfly upslope prior to increasing water levels, whenever that might be. The project has four primary objectives:

1. Establish nectar islands in three upland areas (Lakeside East, Lakeside West and Scoggins Bend) that attract the Fender's blue butterfly and provide resources for them to complete their life cycle;
2. Remove non-native species throughout the project area;
3. Sow and plant native species in areas where weeds have been removed and bare ground is exposed; and
4. Create corridors for the Fender's blue butterfly to migrate upslope.

4. 2019 MANAGEMENT ACTIONS

In 2019, IAE assisted the Service with management actions to help move the project closer to meeting project objectives. Specifically, IAE helped the Service to identify herbicide application and mowing areas for Service subcontractors, completed growing and planting of plugs of Fender's blue butterfly nectar species, hired a subcontractor to mow thatch and encroaching woody plants, removed trees and limbs to expand prairie habitat, cleared trees and shrubs to create a corridor between meadows and completed a survey of Fender's blue butterfly population abundance and habitat quality in the project area at Hagg Lake (Figure 4). A list of tasks completed by IAE at Hagg Lake in since 2018 can be found in Appendix A.



Figure 4. Henry Hagg Lake project area map of nectar island locations, corridor created in 2019, and approximate locations of Kincaid's lupine (*Lupinus oreganus*).

Table 1. Management actions completed at Henry Hagg Lake in 2019.

Date	Personnel*	Task	Location
27-Mar	IAE, Service	Site visit to assess current conditions and discuss future restoration needs of the project area.	Project Area
10-Apr	IAE, Service	Planted 392 Kincaid's lupine in nectar islands 1, 2, 3, and 4.	Lakeside East
11-Apr	IAE	Established transects to assess Fender's blue butterfly population abundance and habitat quality.	Lakeside East and West and Scoggins Bend
24-Apr	Service, Nick's Timber Services	A Service subcontractor spot sprayed fluazifop, a grass specific, across two acres targeting non-native grasses and glyphosate across six acres targeting non-native forbs and shrubs.	<u>Fluazifop</u> : Lakeside East and West <u>Glyphosate</u> : Nectar islands and Scoggins Bend
3-May	IAE	Completed the first of four surveys to assess Fender's blue butterfly population abundance and completed the butterfly habitat quality assessment.	Lakeside East and West and Scoggins Bend
3-May	IAE	Felled and bucked small trees and shrubs to create a corridor between to meadows.	Between Stepping Stone and Lakeside East
6-May	IAE, Service, AmeriCorps Blue 4	Felled and bucked small trees and shrubs to create a corridor between meadows. Material chipped into a Washington County Parks dump truck to be used elsewhere.	Between Stepping Stone and Lakeside East
8-May	IAE	Completed the second of four surveys to assess Fender's blue butterfly population abundance.	Lakeside East and West and Scoggins Bend
13-May	IAE	Completed the third of four surveys to assess Fender's blue butterfly population abundance.	Lakeside East and West and Scoggins Bend
13-May	IAE	Removed lower limbs of Douglas-fir, cut down an apple tree and piled in adjacent forest.	Lakeside East
24-May	IAE	Completed the fourth of four surveys to assess Fender's blue butterfly population abundance.	Lakeside East and West and Scoggins Bend
7-Jun	Service, Nick's Timber Services	A Service subcontractor spot sprayed glyphosate across 16 acres targeting non-native forbs and grasses.	Lakeside East and West, Scoggins Bend, Stepping Stone

Date	Personnel*	Task	Location
14-Jun	IAE	Determined mowing boundary to avoid mowing Kincaid's lupine prior to senescence and bagged Kincaid's lupine to capture ripening seed.	Lakeside East and West
17-Jun	Service, Cutaway Inc.	Over the course of three days, a service subcontractor mowed approximately 10 acres in Lakeside East and West avoiding Kincaid's lupine that was previously marked.	Lakeside East and West
26-Jun	IAE	Collected bags containing mature seed from Kincaid's lupine plants.	Lakeside East and West
2-Jul	Service, Nick's Timber Services	A Service subcontractor spot sprayed triclopyr and clopyralid to areas in Scoggins Bend, Lakeside East and West, and Stepping Stone targeting non-native forbs and shrubs.	Lakeside East and West, Scoggins Bend, Stepping Stone
11-Jul	IAE	Collected remaining bags with mature seed from Kincaid's lupine.	Lakeside East and West
11-Jul	Service, Nick's Timber Services	A Service subcontractor spot sprayed triclopyr and clopyralid to areas in Scoggins Bend, Lakeside East and West, and Stepping Stone targeting non-native forbs and shrubs.	Lakeside East and West, Scoggins Bend, Stepping Stone
15-Jul	IAE	Felled and bucked Douglas-fir trees and piled slash in the adjacent forest. Pulled and bagged knapweed in Lakeside East and removed from site.	Lakeside East and West
23-Jul	IAE, Service	Site visit to assess current conditions and discuss future restoration needs of the project area.	Project Area
28-Aug	Service, Nick's Timber Services	A Service subcontractor spot sprayed Himalayan blackberry, Scotch broom and Queen Anne's lace.	Lakeside East and Stepping Stone
30-Aug	Service, Cutaway Inc.	A Service subcontractor mowed ~7 acres in the eastern portion of Scoggins Bend and part of Lakeside East with a skid steer mower.	Scoggins Bend and Lakeside East
31-Oct	IAE, Cutaway Inc.	An IAE subcontractor used a skid steer mower to mow ~15 acres over the course of three days in October and November.	Lakeside East and West and Scoggins Bend
10-Dec	IAE, Service, AmeriCorps Blue 5	Felled and bucked small trees and shrubs to create a corridor between meadows.	Between Stepping Stone and Lakeside East

Date	Personnel*	Task	Location
13-Dec	IAE, Service, AmeriCorps Blue 5	Felled and bucked small trees and shrubs to create a corridor between meadows. Material chipped into a Washington County Parks dump truck to be used elsewhere on park property. Planted dwarf checkermallow, Oregon geranium, and toughleaf iris in nectar islands 1, 2, 3, 4, 15 and corridor between Lakeside East and West.	Between Stepping Stone and Lakeside East

*Institute for Applied Ecology (IAE), U.S. Fish and Wildlife Service (Service)

4.1. Monitoring: Fender's blue butterfly population and habitat quality

The details and summaries of results of the surveys completed in Fender's blue butterfly habitat at Hagg Lake can be found in two reports prepared for the Service: 1) 2019 Hagg Lake Fender's blue butterfly prairie habitat quality assessments and 2) 2019 status of the Fender's blue butterfly. Hagg Lake Fender's blue butterfly monitoring data collected in 2019 were compiled and analyzed, then integrated into the 2019 Fender's blue Range-Wide Status Report (Menke 2019), and presented at the 2019 Fender's blue butterfly working group meeting in spring 2019. Estimated population abundance of Fender's blue at Hagg Lake was the highest ever in 2018 with an estimated 4,124 butterflies. The population declined in 2019 to an estimated 3,425 individuals.

Fender's blue surveys were completed in May and June 2019, as were lupine and exotic invasive shrub abundance assessments at Lakeside East and Lakeside West (Menke and Ottombrino 2019). Only shrub assessments could be completed at Scoggins Bend (Figure 4), since an accidental herbicide spray during the flight period of the butterfly caused temporary dieback of the Kincaid's lupine. Follow up survey for lupine abundance at Scoggins Bend will be completed in 2020.

4.2. Nectar islands

In 2018, 26 nectar islands (previously referred to as revegetation plots) were established to help encourage the movement of the Fender's blue butterfly upslope and away from the proposed future flood line (Figure 4). The nectar islands were sprayed with herbicide to control all vegetation in 2018 (Esterson 2018). Nectar islands 1, 2, 3, 4 and 15 were planted and seeded with native prairie species, including Fender's blue butterfly nectar and host species in fall 2018 (Appendix B). The remaining nectar islands were maintained in chemical fallow and received herbicide spot spray applications in 2019 to kill all vegetation. Nectar islands 1, 2, 3, 4 and 15 were spot sprayed in 2019 to control non-native species.

In April, IAE and USFWS staff planted 392 Kincaid's lupine plugs in nectar islands 1, 2, 3 and 4 at Hagg Lake. The plugs were grown by IAE from seed previously collected from Hagg Lake.



Figure 5. Pollination bags covering Kincaid's lupine (*Lupinus oreganus*) on June 15. Photo: Andrew Esterson

nectar islands 1, 2, 3, 4, 15 and the corridor between Lakeside East and West (Figure 6). Additional plugs will be planted in early 2020 for a total of 1,340 plugs that were grown by IAE (Table 2 and Figure 6). The plants are intended to improve nectar availability for Fender's blue butterfly.

On June 15, maturing seed pods of Kincaid's lupine in Lakeside East were bagged to collect ripening seed (Figure 5). Bags containing mature seed were collected on June 26 and July 11. The seed was cleaned by IAE staff and these efforts resulted in 0.25 pounds of Kincaid's lupine seed. This seed will eventually be used to grow additional plants that will produce seed for direct seeding or plug production for planting at Hagg Lake or other sites in the Salem West Recovery zone.

In November, IAE staff and AmeriCorps Blue 5 used planting dibbles to plant approximately 900 plugs, including rose checkermallow (*Sidalcea virgata* ssp. *malviflora*), Oregon geranium (*Geranium oreganum*), and toughleaf iris (*Iris tenax*) in



Figure 6. Plugs grown by Institute for Applied Ecology to be planted in Fender's blue butterfly habitat at Hagg Lake. Photo: Ian Silvernail.

Table 2. Native species grown and planted in nectar islands and a corridor in 2019 and 2020.

Scientific Name	Common Name	When	Total
<i>Lupinus oreganus</i>	Kincaid's lupine	April 2019	392
<i>Geranium oreganum</i>	Oregon geranium	Winter 2019-2020	267
<i>Iris tenax</i>	toughleaf iris		759
<i>Sidalcea virgata</i> ssp. <i>malviflora</i>	rose checkermallow		314
Total:			1,732

4.3. Vegetation control

Three types of vegetation control occurred in 2019: herbicide applications, mowing and woody plant removal. All herbicide applications were completed by Nick's Timber Services, a Service subcontractor, using backpack sprayers. All mowing was completed by Cutaway Inc., an IAE and Service subcontractor, using a mower mounted on a skid steer that cuts all vegetation at a height of approximately six inches above the ground. Woody plant removal, including trees and shrubs, was completed by IAE staff and volunteers using chainsaws.

Herbicide applications

In 2019, four herbicides were used to reduce the abundance of non-native species throughout the project area by Nick's Timber Services, a Service subcontractor. Glyphosate, a broad-spectrum herbicide, and fluazifop, a grass-specific herbicide, were spot sprayed in April and June throughout the project area to enhance nectar islands and to kill non-native forbs and grasses. In July and August, the same contractor spot sprayed triclopyr and clopyralid, both broadleaf-specific herbicides, on broadleaf weeds and shrubs, including Himalayan blackberry (*Rubus bifrons*), Canada thistle (*Cirsium arvense*) and poison oak (*Toxicodendron diversilobum*).

Herbicide applications were completed at Stepping Stone for the purpose of maintaining the area in chemical fallow and to prepare it for eventual seeding and planting in 2020. Several non-native species, including large mats of bird vetch (*Vicia cracca*) were growing in Stepping Stone in the fall (Figure 7). The entire meadow should be sprayed with a broad-spectrum herbicide prior to bird vetch flowering (by May 15 at the latest) to maintain the meadow in chemical fallow. An herbicide with preemergent qualities should be considered to prevent seed germination from the soil seedbank, although effects of a preemergent herbicide would mean waiting until 2021 to seed or plant in the area. Locations and dates of all herbicide treatments can be found in Table 1.

A patch of knapweed was discovered in Lakeside East near Kincaid's lupine and was pulled by hand (Figure 8). The plants were bagged and hauled off the site. This patch was marked and remaining plants should be chemically treated or pulled in 2020.



Figure 7. View of Stepping Stone looking west with mats of bird vetch (*Vicia cracca*) on October 31, 2019. Photo: Andy Neill



Figure 8. Knapweed in Lakeside east before (left) and after (right) being pulled and by hand on July 15. Photo: Andrew Esterson

Mowing

Over the course of three days in mid-June, a Service subcontractor mowed approximately ten acres in Lakeside East and Lakeside West, using a rotary mower mounted on a skid steer. Prior to mowing, Kincaid's lupine patches were marked with pin flags so the subcontractor knew to avoid mowing the lupine. The goals of mowing were to 1) expedite the blackberry decomposition process by chopping up canes, and 2) to prevent seed production of non-native species by removing inflorescences prior to seed maturation. After two years of mowing, the Himalayan blackberry canes appear to be broken into small enough fragments that subsequent mowing may not be needed to achieve expedited decomposition. On

August 30th and three days between October 31st and November 4th, the same subcontractor mowed the entire site. Implementing a site-wide mowing is critical for keeping woody species (e.g. Scotch broom) from establishing and reducing thatch accumulation that can both prevent growth and establishment of native species and also limit access of butterflies to available nectar species.

Woody plant removal

To expand and improve connectivity of Fender's blue butterfly habitat at Hagg Lake, IAE staff used chainsaws to fell and buck several trees, including Douglas-fir, an apple tree, and several shrubs and removed lower limbs of remaining Douglas-fir (Figure 9). The felled trees and limbs were bucked then piled in adjacent forest. These efforts effectively expanded butterfly habitat in Lakeside West (Figure 9). A Douglas-fir tree was removed from a corridor that links Lakeside East and Lakeside West (Figure 10).

In May, IAE staff and AmeriCorps Blue 4 began creating 0.7 acre corridor between Stepping Stone and the north part of Lakeside East (Figure 4) by removing trees such as red alder (*Alnus rubra*) and English hawthorn (*Crataegus monogyna*) and shrubs between the two meadows (Figure 11). The corridor was completed by IAE staff and AmeriCorps Blue 5 (Figure 12) in December (Figure 13). Oak and Douglas-fir trees were left uncut. The felled material was hauled to a nearby parking area, piled and eventually chipped with a rented Vermeer BC 1000 chipper into a Washington County Parks dump truck (Figure 11). Washington County Park staff hauled away the chips to be used elsewhere in the park.



Figure 9. A view from the northeast corner of Lakeside West before (left) and after (right) Douglas-fir (*Pseudotsuga menziesii*) removal on July 15, 2019. Photo: Andrew Esterson



Figure 10. View looking northeast into Lakeside East before (left) and after (right) the removal of a Douglas-fir tree on July 15, 2019. Photo: Andrew Esterson



Figure 11. AmeriCorps Blue 4 removing cut material from a corridor that will connect Stepping Stone and Lakeside East (left) and chipping the branches (right) on May 6, 2019. Photo: Andrew Esterson

It is likely that many of the shrubs and trees will resprout in 2020. The regrowth should be treated with herbicide in fall 2020 to prevent regrowth into the future and to maintain an open corridor.



Figure 12. Institute for Applied Ecology staff and AmeriCorps Blue 5 after two days of cutting, hauling and chipping slash from the new corridor between Stepping Stone and Lakeside East. Photo: Rolando Beorchia



Figure 13. Institute for Applied Ecology Restoration Ecologist Peter Moore operating a chainsaw to cut small trees and shrubs at the top of the new corridor on December 10, 2019. Photo: Andy Neill

5. 2020 RECOMMENDATIONS

In 2020, IAE will continue to partner with the Service to move restoration efforts closer to meeting project goals. To do this we recommend the following actions:

- Develop a comprehensive restoration plan for the meadows in the Hagg Lake project area.
- Conduct annual site-wide surveys in spring to determine what areas and species need to be targeted with herbicide applications, hand weeding, tree and limb removal, and mowing.
- Improve Kincaid's lupine habitat and increase populations by:

- Applying a grass-specific herbicide to 1/3 of the occupied Kincaid's lupine habitat in early spring to reduce the abundance of non-native grasses.
 - Producing seed and plugs of Kincaid's lupine for planting in prepared areas at Hagg Lake.
- Implement the following actions within the nectar islands:
 - Monitor nectar islands 1, 2, 3, 4 and 15 to determine success of 2018 and 2019 plantings
 - Apply herbicide to nectar islands that have not received native plant materials to maintain chemical fallow.
 - Hand-pull weeds in nectar islands that have received native plant materials.
 - Spot spray non-native grasses and forbs with herbicides that target specific functional groups in nectar islands that have received native plant materials.
 - Use string trimmers to cut flowering heads of Queen Anne's lace in seeded and planted nectar islands to prevent seed maturation.
 - Plant and seed native prairie species into prepared nectar islands.
- Mowing
 - Mow areas outside of Kincaid's lupine habitat in May to reduce seed set from non-native grasses, especially tall fescue and tall oat grass.
 - Mow one third of Fender's blue butterfly-occupied habitat after Kincaid's lupine has senesced, typically after August 15.
- Woody plant control
 - Apply herbicide to resprouting shrubs and trees that were cut in fall 2019 in the new corridor.
 - Remove Douglas-fir trees and lower limbs from within and around meadows to expand butterfly habitat and create corridors between meadows.
- Maintain Stepping Stone in chemical fallow until 2021 using a variety of chemicals including those with pre-emergent effects.
- Prepare seed mixes and plant materials lists for planting in prepared areas in Stepping Stone, Lakeside East, Lakeside West, and Scoggins Bend.
- Grow and plant Fender's blue butterfly nectar species, including Oregon geranium (*Geranium oregonum*) and toughleaf iris (*Iris tenax*) in prepared areas including nectar islands and around Kincaid's lupine.
- Consider introductions of other federally-listed threatened and endangered plants to Hagg Lake, including golden paintbrush (*Castilleja levisecta*), Willamette daisy (*Erigeron decumbens*) and Nelson's checkermallow (*Sidalcea nelsoniana*).
- Assess logistics of implementation of prescribed burning of meadows in the project area.

6. REFERENCES

Esterson, A. 2018. Fender's blue butterfly habitat restoration at Henry Hagg Lake: 2018 Annual Report. Unpublished report for the U.S. Fish and Wildlife Service, Portland, OR. Institute for Applied Ecology. Corvallis, Oregon.

Menke, C. 2019. Status of the Fender's blue butterfly. Report to U.S. Fish and Wildlife Service and Oregon Parks and Recreation Department: USFWS Agreement #s F18AC00380 and F17AC00464 and OPRD Grant # FY18-E30TW21. 12 pp plus appendix.

Menke, C. and A. Ottombrino. 2019. 2019 Hagg Lake Fender's blue butterfly prairie habitat quality assessments. Report to U.S. Fish and Wildlife Service: USFWS Agreement # F17AC00464. 11 pp plus appendices.

APPENDICES

Appendix A. Summary of Hagg Lake restoration actions in 2018 and 2019.

	Date	Personnel*	Task	Location**
2018	9-Apr	Nick's Timber Services	Herbicide application: fluazifop	Scoggins Bend, Lakeside East and West
	3-May	IAE, Service	Site walk through; select nectar island locations	Project Area
	15-May	Nick's Timber Services	Herbicide application: glyphosate	Scoggins Bend, Stepping Stone, nectar island in Lakeside West
	15-May	Nick's Timber Services	Herbicide application: fluazifop	Lakeside West
	15-May	Nick's Timber Services	Herbicide application: glyphosate and clopyralid	Lakeside East
	25-Jun	Habitat Restoration LLC.	Mowed ~6 acres	Lakeside East and West
	28-Jun	Nick's Timber Services	Herbicide application: triclopyr	Lakeside East and West
	28-Jun	Nick's Timber Services	Herbicide application: glyphosate	All nectar islands
	3-Aug	IAE	Used string trimmer to remove vegetation from nectar islands	Nectar islands 2 and 3
	15-Aug	IAE, Service	Site visit	Scoggins Bend, Lakeside East and West, and Stepping Stone
	27-Aug	IAE	Installed whiskers on each nectar island corner	All nectar islands
	15-Sep	IAE	Mowed nectar islands	Nectar islands 1, 2, 3 and 4
	18-Sep	IAE	Mowed nectar islands	Nectar islands 3, 4 and 15
	20-Sep	Nick's Timber Services	Herbicide application: triclopyr	Scoggins Bend, Lakeside East and West, and Stepping Stone
	20-Sep	Nick's Timber Services	Herbicide application: glyphosate	Portions of Scoggins Bend
	20-Sep	Nick's Timber Services	Herbicide application: glyphosate and clopyralid	Portions of Lakeside West
	15-Oct	IAE	Herbicide application: glyphosate	Nectar islands 1, 2, 3, 4, 15 and Lakeside East
	16-Oct through 22-Oct	Cutaway Inc.	Mowing (5 days)	Scoggins Bend, Lakeside East and West, and Stepping Stone

	Date	Personnel*	Task	Location**
2018	22-Oct	Washington County Sheriff's Dept.	Hand clearing	Scoggins Bend, Lakeside East
	23-Oct	Washington County Sheriff's Dept.	Hand clearing	Scoggins Bend, Lakeside East
	23-Oct	IAE	Planted rose checkermallow plugs	Nectar islands 1, 2, 3 and 4
	29-Oct	IAE	Planted plugs, bareroot, bulbs, and seeded	Nectar islands 1, 2, 3, 4 and 15
	30-Oct	Washington County Sheriff's Dept.	Hand clearing	Scoggins Bend, Lakeside East
2019	27-Mar	IAE, Service	Site visit to assess current conditions and discuss future restoration needs of the project area.	Project Area
	10-Apr	IAE, Service	Planted 392 Kincaid's lupine in nectar islands 1, 2, 3, and 4.	Lakeside East
	11-Apr	IAE	Established transects to assess Fender's blue butterfly population abundance and habitat quality.	Lakeside East and West and Scoggins Bend
	24-Apr	Service, Nick's Timber Services	A Service subcontractor spot sprayed fluazifop, a grass specific, across two acres targeting non-native grasses and glyphosate across 6 acres targeting non-native forbs and shrubs.	<u>Fluazifop</u> : Lakeside East and West <u>Glyphosate</u> : Nectar islands and Scoggins Bend
	3-May	IAE	Completed the first of four surveys to assess Fender's blue butterfly population abundance and completed the butterfly habitat quality assessment.	Lakeside East and West and Scoggins Bend
	3-May	IAE	Felled and bucked small trees and shrubs to create a corridor between to meadows.	Between Stepping Stone and Lakeside East
	6-May	IAE, Service, AmeriCorps Blue 4	Felled and bucked small trees and shrubs to create a corridor between meadows. Material chipped into a Washington County Parks dump truck to be used elsewhere.	Between Stepping Stone and Lakeside East
	8-May	IAE	Completed the second of four surveys to assess Fender's blue butterfly population abundance.	Lakeside East and West and Scoggins Bend

	Date	Personnel*	Task	Location**
2019	13-May	IAE	Completed the third of four surveys to assess Fender's blue butterfly population abundance.	Lakeside East and West and Scoggins Bend
	13-May	IAE	Removed lower limbs of Douglas-fir, cut down an apple tree and piled in adjacent forest.	Lakeside East
	24-May	IAE	Completed the fourth of four surveys to assess Fender's blue butterfly population abundance.	Lakeside East and West and Scoggins Bend
	7-Jun	Service, Nick's Timber Services	A Service subcontractor spot sprayed glyphosate across 16 acres targeting non-native forbs and grasses.	Lakeside East and West, Scoggins Bend, Stepping Stone
	14-Jun	IAE	Determined mowing boundary to avoid mowing Kincaid's lupine prior to senescence and bagged Kincaid's lupine to capture ripening seed.	Lakeside East and West
	17-Jun	Service, Cutaway Inc.	Over the course of three days a service subcontractor mowed approximately 10 acres in Lakeside East and West avoiding Kincaid's lupine that was previously marked.	Lakeside East and West
	26-Jun	IAE	Collected bags containing mature seed from Kincaid's lupine plants.	Lakeside East and West
	2-Jul	Service, Nick's Timber Services	A Service subcontractor spot sprayed triclopyr and clopyralid to areas in Scoggins Bend, Lakeside East and West, and Stepping Stone targeting non-native forbs and shrubs.	Lakeside East and West, Scoggins Bend, Stepping Stone
	11-Jul	IAE	Collected remaining bags with mature seed from Kincaid's lupine.	Lakeside East and West
	11-Jul	Service, Nick's Timber Services	A Service subcontractor spot sprayed triclopyr and clopyralid to areas in Scoggins Bend, Lakeside East and West, and Stepping Stone targeting non-native forbs and shrubs.	Lakeside East and West, Scoggins Bend, Stepping Stone
	15-Jul	IAE	Felled and bucked Douglas-fir trees and piled slash in the adjacent forest. Pulled and bagged knapweed in Lakeside East and removed from site.	Lakeside East and West
	23-Jul	IAE, Service	Site visit to assess current conditions and discuss future restoration needs of the project area.	Project Area

	Date	Personnel*	Task	Location**
2019	28-Aug	Service, Nick's Timber Services	A Service subcontractor spot sprayed Himalayan blackberry, Scotch broom and Queen Anne's lace.	Lakeside East and Stepping Stone
	30-Aug	Service, Cutaway Inc.	A Service subcontractor mowed ~7 acres in the eastern portion of Scoggins Bend and part of Lakeside East with a skid steer mower.	Scoggins Bend and Lakeside East
	31-Oct	IAE, Cutaway Inc.	An IAE subcontractor used a skid steer mower to mow ~15 acres over the course of three days in October and November.	Lakeside East and West and Scoggins Bend
	10-Dec	IAE, Service, AmeriCorps Blue 5	Felled and bucked small trees and shrubs to create a corridor between meadows.	Between Stepping Stone and Lakeside East
	13-Dec	IAE, Service, AmeriCorps Blue 5	Felled and bucked small trees and shrubs to create a corridor between meadows. Material chipped into a Washington County Parks dump truck to be used elsewhere on park property. Planted dwarf checkermallow, Oregon geranium, and toughleaf iris in nectar islands 1, 2, 3, 4, 15 and corridor between Lakeside East and West.	Between Stepping Stone and Lakeside East

Appendix B. Plant materials planted at Henry Hagg Lake in 2018

Native species planted into nectar islands 1, 2, 3, 4 and 15

Scientific Name	Common Name	Material	Size	Total
<i>Allium acuminatum</i>	tapertip onion	Bulb	s	200
<i>Allium amplexans</i>	narrowleaf onion	Bulb	m	200
<i>Brodiaea coronaria</i>	crown Brodiaea	Bareroot	s-m	200
<i>Calochortus tolmiei</i>	Tolmie's mariposa lily	Bulb	s	200
<i>Dichelostemma congestum</i>	forktooth ookow	Bulb	m	200
<i>Fragaria virginiana</i>	Virginia strawberry	Bareroot	br	200
<i>Iris tenax</i>	toughleaf iris	Bareroot	m	200
<i>Sidalcea virgata</i> ssp. <i>malviflora</i>	rose checkermallow	Plug	5.5-inch	396
<i>Wyethia angustifolia</i>	narrowleaf mule's ear	Bareroot	m	25
			Total:	1821

Native species direct-seeded to nectar islands 1, 2, 3, 4 and 15

Scientific Name	Common Name	lbs. seed	PLS
<i>Achillea millefolium</i> var. <i>occidentalis</i>	western yarrow	0.4	87
<i>Acmispon americanum</i>	American bird's-foot trefoil	8.7	N/A
<i>Clarkia amoena</i> var. <i>lindleyi</i>	farewell to spring	0.5	89
<i>Collinsia grandiflora</i>	large flowered blue-eye Mary	1.1	94
<i>Eriophyllum lanatum</i>	wooly sunflower	0.6	N/A
<i>Festuca roemerii</i>	Roemer's fescue	2.6	N/A
<i>Ligusticum apiifolium</i>	celery-leaved lovage	2.7	45
<i>Lomatium triternatum</i>	nineleaf biscuitroot	1	N/A
<i>Lupinus oreganus</i>	Kincaid's lupine	0.1	N/A
<i>Luzula comosa</i>	common woodrush	0.6	N/A
<i>Madia elegans</i>	showy tarweed	1.4	N/A
<i>Madia gracilis</i>	grassy tarweed	1.5	70
<i>Plectritis congesta</i>	shortspur seablush	0.4	N/A
<i>Potentilla gracilis</i>	slender cinquefoil	0.2	N/A
<i>Prunella vulgaris</i> var. <i>lanceolata</i>	self-heal	1.3	94
<i>Ranunculus occidentalis</i>	western buttercup	1.9	70
<i>Sidalcea campestris</i>	meadow checkerbloom	3.8	N/A
<i>Sidalcea malviflora</i> ssp. <i>virgata</i>	rose checkermallow	3	N/A
	Total:	31.58	