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Crater Lake National Park

Steel Visitor Center Rehabilitation Revegetation Project

2021 Annual Report

ON THIS PAGE
Steel Visitor Center, summer 2021.
Photo by Carrie Wyler

ON THE COVER
Steel Visitor Center, summer 1983.
Photo courtesy of the Library of Congress.

Steel Visitor Center Rehabilitation Revegetation Project

2021 Annual Report

Scott E. Heisler, Carolyn S. Wyler, and Jennifer S. Hooke

National Park Service
Crater Lake National Park
P.O. Box 7
Crater Lake, Oregon 97604

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Abstract

Crater Lake National Park's Steel Visitor Center is slated for a major rehabilitation project beginning in fall 2021. The Steel Visitor Center serves as the only year-round visitor information center for the Park, houses the post office, and also provides office space supporting Park operations. The Botany program has been given responsibility for revegetating disturbed natural areas after construction once the rehabilitation is completed. Revegetation efforts during the 2021 field season included site documentation and planning, collecting seed from 30 different plant species, salvaging 42 pots of plants, caring for 3,035 plants, and seeding just under 600 pots for propagation. The project area was surveyed for invasive plants and 3,945 were found and treated. Revegetation work is planned to continue into the 2022 season by expanding and increasing seed collection efforts, caring for propagated and salvaged plants, and continuing to survey for and control invasive plant species.

Acknowledgments

The Denver Service Center staff, especially Andrea Lind, assisted with planning and securing funding for revegetation efforts related to this project. Field and data entry assistance were provided by David Larkin and River Allen. Early and frequent communication with the Crater Lake National Park Maintenance Division, namely Kirsten Hardin, allowed revegetation and construction planning to occur in tandem. The U.S. Forest Service Dorena Genetic Resource Center aided with seed cleaning and providing plant materials for restoration.

Introduction

Crater Lake National Park's (CRLA) Steel Visitor Center (VC) located in Munson Valley's Historic District is one of the gateways to the Park and the only year-round center for visitors to gather Park information. The Steel Visitor Center was originally built as a ranger dormitory in 1932, and decades of heavy snow loading have taken their toll on the building's integrity. The current rehabilitation project is tasked with: 1) correcting significant structural deficiencies in the stone walls, foundation, and second floor and roof wood framing; 2) providing seismic upgrades and increased load-bearing capacities; 3) replacing building systems; 4) replacing roofing; 5) ensuring the building is compliant with current building codes; and 6) enhancing the building's energy efficiency. In the process of reconstructing and rehabilitating the Steel VC, the landscape adjacent to the building will be damaged and/or destroyed by the need to replace foundations, stage and store materials, and maneuver construction vehicles and equipment around the work site. The CRLA Botany program has been tasked with revegetation work in association with this project.

The Steel VC is part of the Munson Valley Historic District, which was listed in the National Register of Historic Places in 1988. The Munson Valley Historic District is significant because it contains a historic designed landscape that is representative of "naturalistic" landscape design of the 1930s (Pavlik 2013). Between 1933-1934 over a thousand trees and several thousand shrubs were transplanted to the area as part of the "naturalization" program for the site. Large quantities of topsoil and peat were brought in from the south end of Munson Valley to amend the soils, and in some cases, to replace the pumice soil prior to planting. A specific suite of plants was placed around the building to soften the stone masonry and blend the building into the natural landscape (Pavlik 2013), some of which are still surviving and are termed "Foundation Plantings."

Construction activities on this project are expected to create a large disturbance footprint in a culturally significant area subject to high visitor use (Figure 1). During construction, the Steel VC will be closed to the public requiring the establishment of a temporary visitor center sited in Mazama Village adjacent to the Camper Store (Figure 2). The establishment of the Temporary VC will create ground disturbance requiring subsequent revegetation work when it is no longer needed.

In anticipation of the substantial impacts to soils and vegetation, the Crater Lake Botany program received funding to restore affected areas through revegetation and invasive vegetation management. The objectives of this work are:

1. Developing revegetation prescriptions for disturbed areas to be restored.
2. Surveying for and controlling non-native, invasive plant species within the project area.
3. Salvaging, transplanting, and monitoring Foundation Plantings impacted by the project.
4. Collecting native seed and plant materials for revegetation efforts.
5. Restoring affected areas through site preparation, planting, and seeding.
6. Monitoring restored areas for revegetation efficacy and augmenting restoration actions.

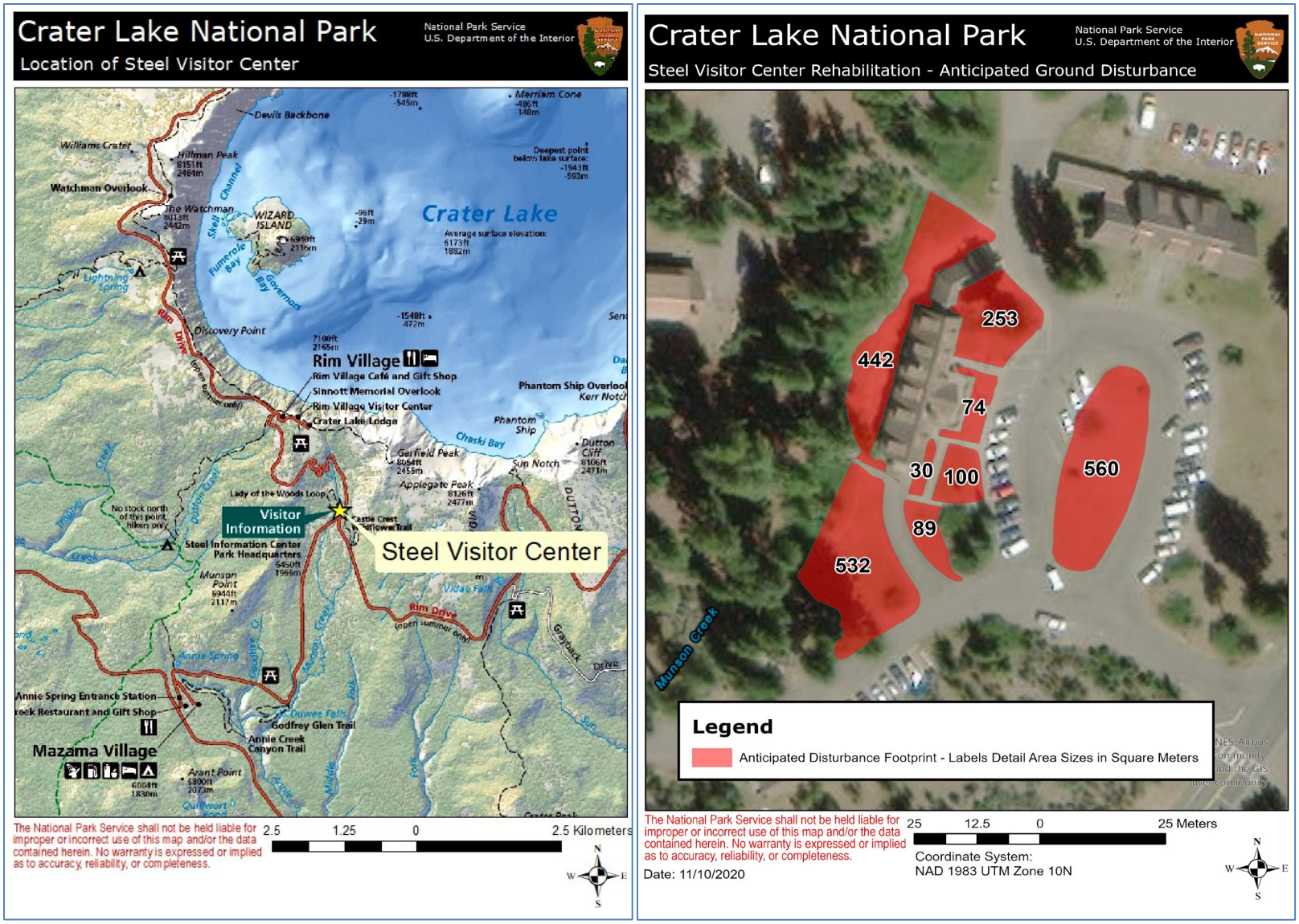

Figure 1. Location of the Steel Visitor Center within the Park (left). Anticipated disturbance areas (highlighted in red) at the Steel Visitor Center (right). Maps by Scott Heisler.

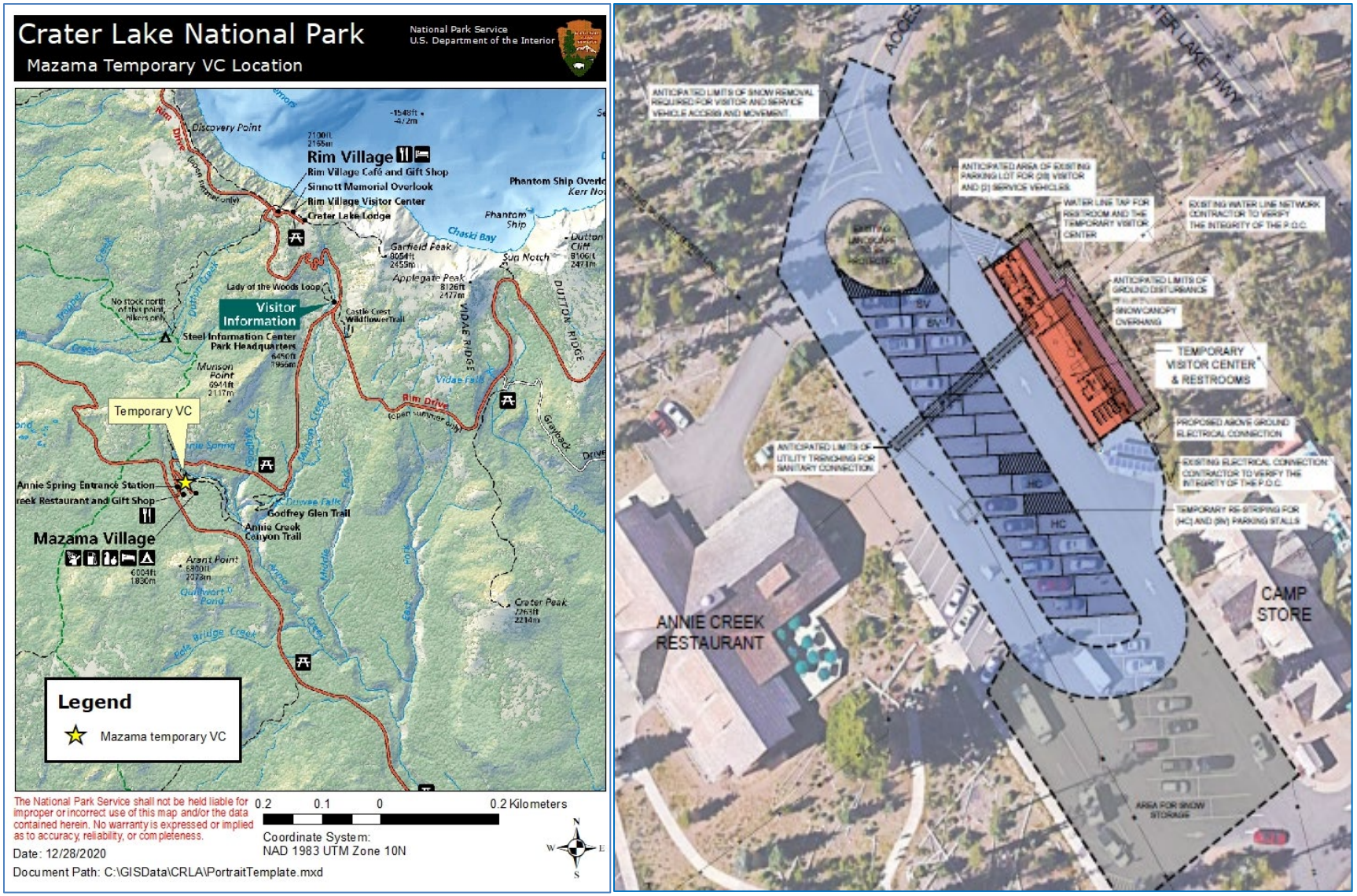

Figure 2. Location of the Temporary VC at Mazama Village (left). Map by Carrie Wyler. Drawing of the Temporary VC facilities (red and purple shading) near the Mazama Village Camper Store (right). Image provided by the Denver Service Center.

Construction work began during 2021 and will continue into 2022. No ground disturbance occurred during the 2021 field season, but temporary fencing was installed, and work was initiated on the interior of the building. A temporary mobile structure for the Park's post office (Figure 3) was installed on the sidewalk and vegetation in the area across from the Steel VC (Figure 3), which created minor ground disturbance when leveled. In 2021, field work for this project was performed by seasonal Biological Science Technicians, with the field season lasting from May 24th to November 15th.

Figure 3. Temporary mobile post office structure (left -photo by Carrie Wyler) location at HQ parking lot (green rectangle at right – image courtesy of Ausland Group construction company).

Restoration of disturbed areas around the Steel VC and Temporary VC will jumpstart natural succession of vegetation communities and protect the area from erosion and invasion by non-native plant species. These restoration efforts will yield additional aesthetic benefits to Park visitors by addressing existing bare, disturbed ground throughout the project area (Figure 4).

The Botany program's 2021 work progress on the Steel VC Rehabilitation Revegetation project will be discussed in two components: (1) revegetation and (2) invasive vegetation management. The revegetation component is further divided into four sections: (1) site prescriptions, (2) seed collection, (3) Foundation Planting salvage, and (4) plant material propagation.

Figure 4. Trampled areas adjacent to high traffic pathways in front of the Steel VC, showing compacted soil devoid of vegetation. Photo by Carrie Wyler.

Methods

Revegetation

Site Prescriptions

Revegetation site prescriptions for the project's anticipated disturbance footprint were developed in July of 2020, prior to the commencement of construction activities. These prescriptions document the pre-disturbance site features and plant community composition unique to the area and serve to guide plant material needs and the evaluation of restoration efficacy. A revegetation plan was developed that details how many and which plants will be used to retore the project area (Wyler and Hooke 2022).

Seed Collection

The two project areas (Steel VC and Temporary VC) and their surrounding quarter-mile radii are considered the seed zones for the project. These two seed zones serve as distinct areas where seeds and propagated plants can be sourced and moved while preserving site-specific biodiversity and genetic integrity. Species identified as occurring in the project areas, with an emphasis on

Foundation Planting species (see section on Foundation Planting salvage), were targeted for seed collection. Priorities for bulk seed collection were based upon seed availability and the need for use in nursery propagation. Table 1 lists all plant species collected from for the Steel VC. No seed collection was conducted at the temporary VC location this year due to planning uncertainties for the site, but seed was collected during 2020. Seed collection was conducted during the 2019--2021 field seasons for the Steel VC. Target seed collection levels of 10-12 pounds per acre were set. As per the "Seed Collection in National Parks" manual (Taliga et al. 2015), seed is ideally collected from 30 - 100 individual plants per population, taking care not to collect more than 20% of seed from the total population unless the area is slated for removal due to construction, in which case as much seed as possible should be collected. Phenology of dominant plant species was recorded within the project's seed zones to monitor mature seed collection windows for both 2021 and future collection years.

Table 1. Seed collection plant taxa list for the Steel VC.

Scientific Name	**Common Name**
Agoseris aurantiaca var. *aurantiaca*	Orange agoseris
Anaphalis margaritacea	Pearly everlasting
Bromus sitchensis var. *carinatus*	California brome
Calamagrostis rubescens	Pinegrass
Calyptridium umbellatum	Pussypaws
Carex pachycarpa	Many-rib sedge
Carex preslii	Presl's sedge
Carex spectabilis	Showy sedge
Carex straminiformis	Shasta sedge
Chamaenerion angustifolium var. *canescens*	Fireweed
Cinna latifolia	Slender woodreed
Dicentra formosa ssp. *formosa*	Pacific bleeding heart
Elymus elymoides ssp. *elymoides*	Common squirreltail
Elymus glaucus ssp. *glaucus*	Blue wildrye
Ericameria greenei	Greene's goldenbush
Erigeron glacialis var. *glacialis*	Peregrine fleabane
Eriocoma occidentalis	Western needlegrass
Eriogonum marifolium var. *marifolium*	Sierra eriogonum
Eucephalus ledophyllus	Cascade aster
Ligusticum grayi	Gray's licorice-root
Lupinus albicaulis var. *shastensis*	Pine lupine
Nothocalais alpestris	Alpine lake false dandelion
Penstemon rydbergii var. *oreocharis*	Rydberg's penstemon
Phacelia mutabilis	Changeable phacelia

Scientific Name	Common Name
Ribes cereum var. *cereum*	Wax currant
Ribes viscosissimum	Sticky currant
Senecio triangularis	Arrowleaf groundsel
Solidago elongata	Narrow goldenrod
Sorbus scopulina	Greene's mountain ash
Spiraea splendens	Subalpine spiraea

When seeds were mature, they were collected, dried, and stored until shipment to the USFS Dorena Genetic Resource Center (DGRC). A single bag was used to collect all the seed from an individual species if the species was to be used for propagation purposes (Figure 4), otherwise species were combined into seed mixes for ease of collection. Collection bags were labelled with species code and collection date. After collection, seeds were transported to the seed drying and storage facility in the Stall Two garage at Park headquarters (Figure 5). Collected seed was placed inside 30-gallon plastic storage totes secured with window screen at the top, allowing ventilation while reducing chances of predation. Plant species with very small seeds were first placed in smaller plastic bins before being stored within the larger 30-gallon tubs. The tubs were labelled and organized on shelves by seed zone and plant species. Damp collections (especially lupines) were either shipped soon after collection (within a week) or set out in the sun during the day to speed the drying process.

Figure 5. Seed drying and storage facility at Park headquarters (left). Collected seed mix before cleaning (right). Photos by Carrie Wyler.

Foundation Planting Salvage

Foundation Plantings around the Steel VC are individual plants that are likely relicts originating from landscaping efforts in the 1930s. These plantings are considered part of the Munson Valley Historic District's Cultural Landscape (Pavlik 2013) and retaining them as part of the contemporary landscape is a revegetation priority. In August 2020, a walkthrough of the Steel VC project area was conducted

by Botany program staff and the CRLA Park Historian to identify Foundation Plantings. A list of plant species included in the 1930s landscaping efforts (Appendix A) was obtained from the Munson Valley Historic District Cultural Landscape Inventory (Pavlik 2013). No plants were salvaged from the Temporary VC site.

Salvage of Foundation Plantings was conducted in October 2020 and September 2021, as late into the progression to winter dormancy as weather and the field season allowed (Figure 6). Certain plant species were targeted for salvaging based on the Botany program's experience with salvaged plant survivorship in other projects, with grasses, sedges, and rushes having substantially greater success than forb species. Several mature specimens of plant species not listed as Foundation Plantings, along with collections of moss species, were additionally collected from the anticipated disturbance footprint. These additional species were uncommon in the project areas and/or not well represented in seed collection efforts.

Figure 6. Salvaging plants from the anticipated disturbance areas at the Steel Visitor Center. Photos by Carrie Wyler.

Salvaged plants were classified as being in one of the two Steel VC seed zones: east and south of the Steel VC in sunny areas; and west of the Steel VC in shadier or wetter areas. Salvaged plants were arranged by seed zone in the Ball Diamond nursery for the purpose of guiding care and outplanting. Salvaging consisted of locating Foundation Plantings or mature plant species within the project's anticipated disturbance footprint; cutting the specimen from the ground by undercutting the root ball

with a spade; placing the root ball into an appropriately sized pot; and tamping in soil to fill any gaps left in the pot. Salvaged stock was then watered to settle the roots in the soil, and the pots were placed in the Botany program's shadehouse facility at the Ball Diamond nursery to allow for recovery from transplant shock. These plants are overwintered and cared for at the nursery until outplanted at project completion (Figure 7). The specifics of this care are detailed in established Botany program nursery protocols on file at CRLA.

Figure 7. Shadehouse at the Ball Diamond nursery where salvaged plants are cared for until they can be replanted at the Steel VC (left). Plants consolidated and surrounded with mulch for overwintering (right). Photos by Carrie Wyler.

Plant Material Propagation

Plant species chosen for propagation were selected based on past success with propagation at the Park, Foundation Planting species status, and dominance of plant species in the disturbance footprint. Propagation of native plants from seed poses difficulties for the Botany program due to the lack of equipment and year-round facilities needed for cold stratification of seeds and early season plant care. To address these difficulties, plant propagation techniques utilize Crater Lake's abundant snowpack to cold stratify seeded pots, allowing the plant propagation schedule to align with the present Botany field season. More difficult to propagate species and plants propagated from cuttings are being produced by the DGRC in Cottage Grove, Oregon.

Invasive Vegetation Management

In 2021, the project area was surveyed for non-native, invasive plant species. When invasive plants are encountered, data are recorded using ArcGIS Collector including scientific name, geographic coordinates, total number of plants present, area occupied by invasive plants, and treatment applied to the population. Invasive plants are controlled via manual or chemical methods (Figure 8) as per the Park's Invasive Vegetation Management Plan (DOI NPS 2017). All plant parts capable of reproduction are bagged and disposed of in the trash compactor at Park headquarters. Vegetative parts incapable of reproduction are left to desiccate on site unless they present logistical or aesthetic problems for Park visitors, employees, and partners.

Figure 8. Signage notifying the public of an herbicide application (marked with temporary red dye) for invasive plant control in front of the Steel VC. Photo by Carrie Wyler.

Results

Revegetation

Site Prescriptions

Revegetation site prescriptions were developed for the anticipated disturbance footprints at the Steel VC and Temporary VC locations and can be found in the project's revegetation plan (Wyler and Hooke 2022). A complete list of plant taxa identified on site can be found in Appendix B.

Seed Collection

Plant phenology was monitored from June 29-October 12 during the 2021 field season. Snow-free dates at Park headquarters were June 11 to October 14 in 2021. Seed collection began in mid-July 2021 and continued through the end of September. The peak seed collection for most plant species occurred from early August to early September (Table 2). The 2021 growing season was notable for extreme drought conditions and the hottest summer on record as reported by the servicing National Weather Service office (Sandler 2021), including a severe heat wave in late June. The effect of these biotic stresses within the project area was readily visible in plant growth rates and seed production quantities.

Table 2. 2021 seed collection periods for key species indicated by gray shading.

Species	July (mid)	July (late)	AUG (early)	AUG (mid)	AUG (late)	SEPT (early)	SEPT (mid)	SEPT (late)	OCT (early)	OCT (mid)	OCT (late)
Eriocoma occidentalis											
Agoseris species											
Bromus sitchensis var. *carinatus*											
Calyptridium umbellatum											
Carex species											
Elymus elymoides ssp. *elymoides*											
Elymus glaucus											
Ericameria greenei											
Erigeron glacialis											
Eucephalus ledophyllus											
Lupinus albicaulis var. *shastensis*											
Phacelia mutabilis											
Solidago elongata											
Spiraea splendens											

Grasses, composites, and sedges produced abundant seed that was easy to collect, and thus made up the bulk of the 2021 seed collection. Quantities of seed collected in 2019, 2020 and 2021 are listed in Table 3. Some seed collected during 2021 was sent to the DGRC to be cleaned and stored until needed. Seed collected as mixes and seed from certain easy-to-clean species were cleaned in-house by Botany program staff.

Table 3. Seed collection quantities from 2019, 2020, and 2021.

Plant Species	Quantity (grams) collected 2019 Steel VC	Quantity (grams) collected 2020 Steel VC	Quantity (grams) collected 2020 Temporary VC	Quantity (grams) collected Steel VC 2021	Location of cleaning
Asteraceae species mix*	42.0	0	11.0	152.0	CRLA
Bromus sitchensis var. *carinatus*	8.0	85.73	22.31	27.0	DGRC/ CRLA
Carex species mix*	0	3.33	15.62	104	DGRC/ CRLA
Dicentra formosa ssp. *formosa*	0	2.84	0	0	DGRC
Elymus elymoides ssp. *elymoides*	0	10.56	25.0	15.0	DGRC/ CRLA
Elymus glaucus ssp. *glaucus*	0	15.07	12.43	23.0	DGRC
Eriocoma occidentalis	0	25.52	12.5	18.54	DGRC/ CRLA
Eucephalus ledophyllus	0	4.16	0	*	DGRC
Ligusticum grayi	0	6.25	0	1.0	DGRC
Lonicera involucrata var. *involucrata*	0	1.0	0	0	CRLA
Lupinus albicaulis var. *shastensis*	0	19.99	0	*	DGRC
Lupinus species mix*	0	0	2.52	24.0	DGRC
Penstemon rydbergii var. *oreocharis*	175.0	10.98	0	240.91	DGRC
Phacelia mutabilis	0	1.8	0	*	DGRC
Ribes cereum var. *cereum*	0	1.0	0	1.0	CRLA
Solidago elongata	18.0	71.57	0	280.62	CRLA
Sorbus scopulina	0	Cuttings	0	11.0	DGRC/ CRLA
Spiraea splendens	60.0	0.71	0	*	DGRC/ CRLA
Riparian grass mix*	0	32.0	0	3.0	CRLA
Mix (rough cleaned)*	404.0	169.0	0	51.0	CRLA
TOTAL	**707.0**	**461.51**	**101.38**	**951.07**	

*Plant species were not collected individually but combined in a mix due to not being needed for propagation.

Foundation Planting Salvage

In total, 264 containers of salvaged plants were collected from around the Steel VC (Figure 9) during 2020-2021. The quantities of each pot size from the two seed zones are listed in Table 4.

Table 4. Quantities of plants salvaged from the Steel VC.

Salvage Location (Seed Zone)	Pot size	Quantity from 10/14/20	Quantity from 9/9/21
East and South of the VC in sunny areas	1 gallon	57	35
East and South of the VC in sunny areas	3 gallons	11	0
East and South of the VC in sunny areas	8 gallons	1	0
West of the VC or shadier or wetter areas	1 gallon	133	5
West of the VC or shadier or wetter areas	3 gallons	15	2
West of the VC or shadier or wetter areas	5 gallons	2	0
West of the VC or shadier or wetter areas	flats of moss	3	0
	TOTAL	**222**	**42**

Figure 9. Salvaged plants at the Steel VC (left) and at the Ball Diamond nursery (right). Photos by Carrie Wyler.

Plant Material Propagation

Eighteen plant species were targeted for plant propagation efforts (Table 5). In 2020 eight plant species were propagated at the DGRC (five from seed and three from cuttings), and ten species were propagated by seed at CRLA. Germination and rooting success were evaluated during the 2021 field season and results can be found in Table 6. In October of 2021, a total of 588 pots were seeded at CRLA and are presently in cold stratification under the snowpack at the Ball Diamond nursery (Figure 10).

Table 5. Number of plants propagated at CRLA and the DGRC for the Steel VC Rehabilitation project.

Location	Scientific Name	Quantity fall 2020	Quantity fall 2021
CRLA	*Eriocoma occidentalis*	490	98
CRLA	*Bromus sitchensis* var. *carinatus*	196	0
DGRC/CRLA	*Carex* species mix	784	196
DGRC	*Dicentra formosa* ssp. *formosa*	50	0

Location	Scientific Name	Quantity fall 2020	Quantity fall 2021
CRLA	*Elymus elymoides* ssp. *elymoides*	98	0
CRLA	*Elymus glaucus* ssp. *glaucus*	196	0
DGRC	*Ericameria greenei*	196	0
DGRC	*Eucephalus ledophyllus*	294	0
CRLA	*Lonicera involucrata* var. *involucrata*	46	0
CRLA	*Penstemon rydbergii* var. *oreocharis*	490	0
CRLA	*Phacelia mutabilis*	98	0
CRLA	*Ribes* species	98	0
CRLA	Riparian grass mix	196	0
DGRC	*Salix commutata**	20	0
CRLA	*Solidago elongata*	196	294
DGRC	*Sorbus scopulina**	40	0
DGRC	*Spiraea splendens*	50	0
	TOTAL	**3,558**	**588**

*Propagation via cuttings instead of seed.

Table 6. Inventory of plants successfully germinated from 2020 propagation for the Steel VC Rehabilitation project as of October 2021.

Scientific Name	Inventory as of fall 2021
Eriocoma occidentalis	419
Bromus sitchensis var. *carinatus*	170
Carex species mix	651
Elymus elymoides ssp. *elymoides*	78
Elymus glaucus ssp. *glaucus*	189
Ericameria greenei	49
Eucephalus ledophyllus	242
Lonicera involucrata var. *involucrata*	29
Penstemon rydbergii var. *oreocharis*	374
Phacelia mutabilis	75
Ribes species	73
Riparian grass mix	167
*Salix commutata**	4
Solidago elongata	196
Spiraea splendens	97
TOTAL	**2,813**

*Propagation via cuttings instead of seed.

Figure 10. Propagating plants from seed at CRLA for the Steel VC Rehabilitation project (left). Grouped plants being overwintered at the Ball Diamond nursery (right). Photos by Carrie Wyler.

Invasive Vegetation Management

A total of 263 invasive plants were encountered and treated in the Steel VC project area during the 2021 season. At the temporary VC location at Mazama Village, 3,682 invasive plants were found and treated in 2021. A map of invasive plant populations around the Steel VC is displayed in Figure 11 and the temporary VC populations at Mazama Village are shown in Figure 12. Many of the invasive plants were challenging to treat because they were tightly admixed with native plants. Multiple treatments occurred throughout the season in order to treat invasive plants that were missed earlier.

A list of invasive plant species treated at the Steel VC can be found in Table 7, and invasive plant species treated at the temporary VC area at Mazama Village is displayed in Table 8. Most invasive plant species saw numbers decrease from 2020-2021 due to the effectiveness of using herbicide. However, red sand-spurrey had a large decrease in abundance from 2020 to 2021 most likely due to the inaccessibility of a large area of the project area due to construction closures.

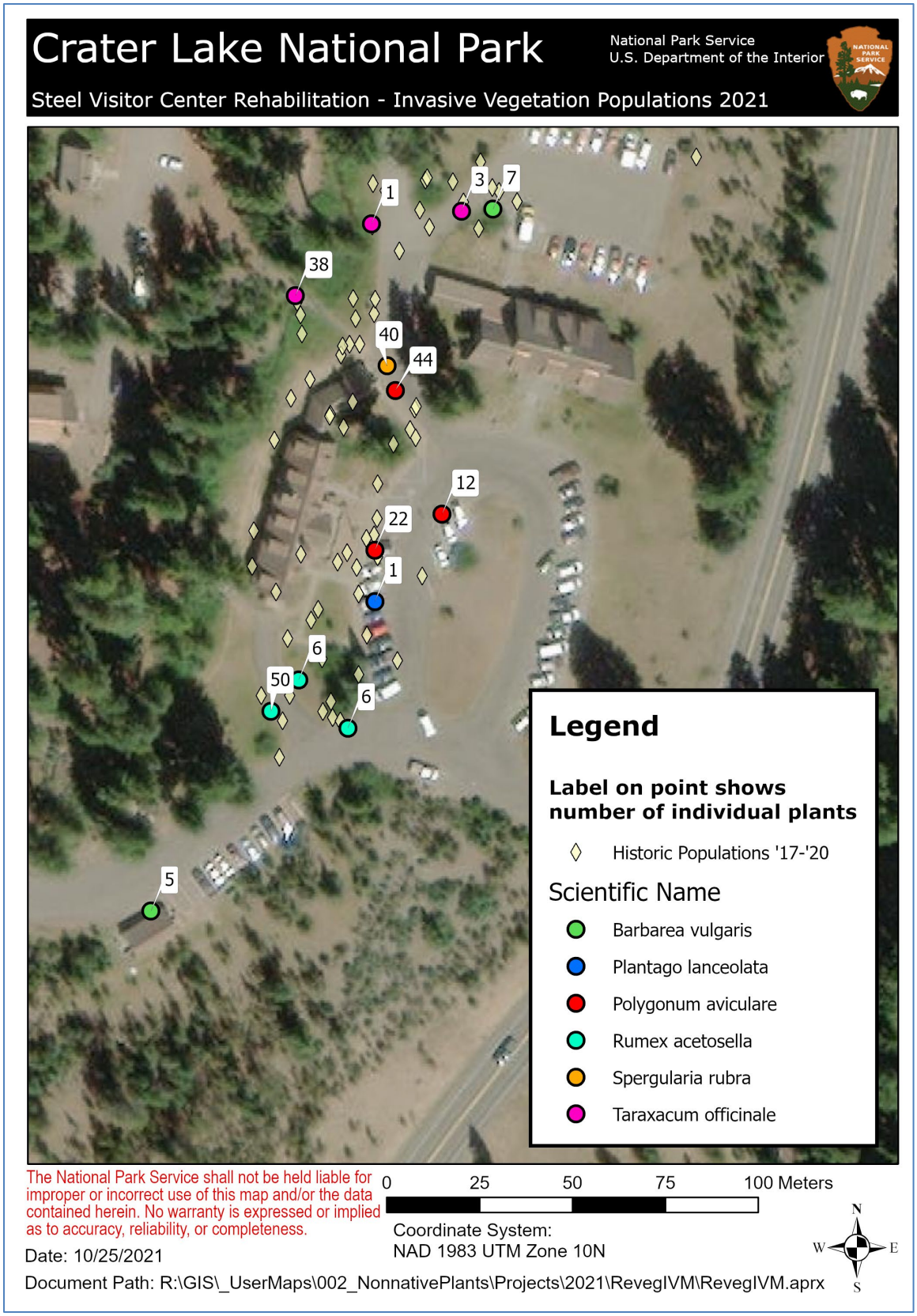

Figure 11. Current and historic invasive plant populations at the Steel VC. Map by Scott Heisler.

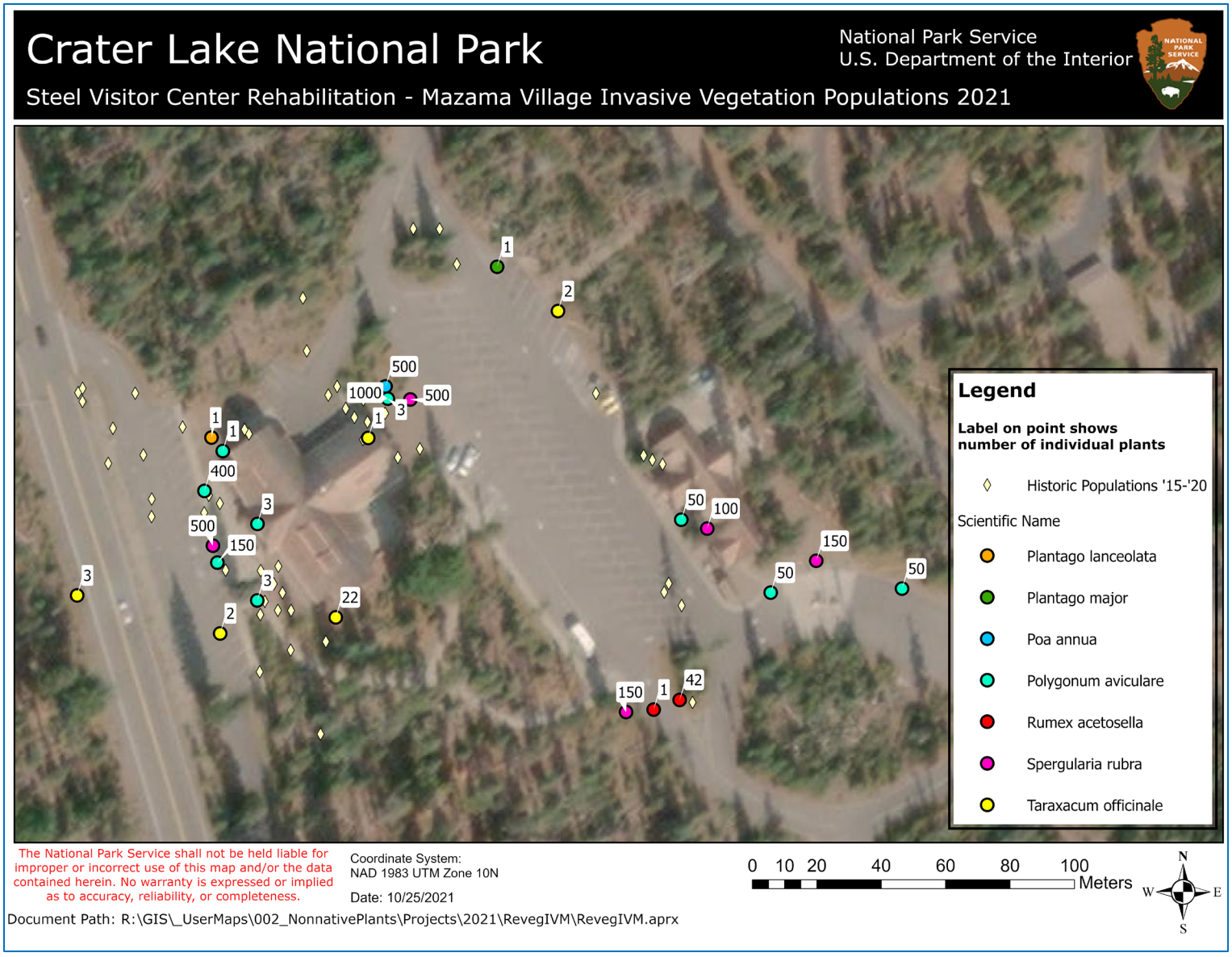

Figure 12. Current and historic invasive plant populations at the temporary VC site at Mazama Village. Map by Scott Heisler.

Table 7. Abundance (number of individual plants) of treated invasive plants within the Steel VC project area for 2020 and 2021.

Invasive Plant Species	2020 Abundance	2021 Abundance
Annual bluegrass (*Poa annua*)	38	0
Common knotweed (*Polygonum aviculare* ssp. *depressum*)	133	79
Sheep sorrel (*Rumex acetosella)*	388	62
Red sand-spurrey (*Spergularia rubra*)	6,076	40
Bitter winter cress (*Barbarea vulgaris)*	35	12
Common dandelion (*Taraxacum officinale*)	4	42
Total	**6,674**	**263**

Table 8. Abundance (number of individual plants) of treated invasive plants within the temporary Mazama Village VC project area for 2021.

Invasive Plant Species	2020 Abundance	2021 Abundance
Buckhorn plantain *(Plantago lanceolata)*	0	1
Common plantain *(Plantago major)*	0	1
Annual bluegrass (*Poa annua*)	0	500
Common knotweed (*Polygonum aviculare* ssp. *depressum*)	125	710
Sheep sorrel (*Rumex acetosella)*	37	43
Red sand-spurrey (*Spergularia rubra*)	0	2,400
Common dandelion (*Taraxacum officinale*)	5	27
Total	**167**	**3,682**

Discussion

As construction continues in 2022, revegetation work will focus on seed collection, care of propagated and salvaged plants, surveying for and controlling invasive plants, and monitoring the area for unplanned disturbance.

Recommendations and needs for Steel VC Rehabilitation Revegetation Project in the 2022 field season include:

- All salvaged plants and newly propagated plants will need to be assessed for status and health. Plants will need fertilization to assist with survival and growth. All containerized plants should be checked for moss or liverwort growth, which should be removed if present to prevent disease.
- More seed will need to be collected in the surrounding area when construction impacts become more apparent.

- The entire project areas need to be thoroughly surveyed for invasive plants at least three times throughout the field season.
- Any unanticipated newly disturbed areas need to be documented.
- The National Weather Service has an extremely useful weather database with daily, monthly, and yearly data summaries (https://w2.weather.gov/climate/xmacis.php?wfo=mfr) that should be used to help inform when to water newly planted seedlings and provides information for seed collection. It also facilitates year-to-year comparisons by providing data on annual snow loads and precipitation amounts.
- Landscaping islands and beds in the project area are particularly difficult areas to restore and maintain, as these areas are heavily trampled by visitors and employees (Figure 13). These areas will need to be assessed yearly for traffic patterns and trampling and filled in with plants as problem areas arise. Fencing will be needed to protect emerging and newly established vegetation. This has been found to be very successful at the Park's Rim Village area which is also impacted by large number of visitors (Figure 14).
- Fencing will need to be procured early in the 2022 season, so materials are available as needed in late 2022 and early 2023. Fence post receivers should be installed in fall 2022 to facilitate fencing installation come snowmelt in 2023.

Figure 13. Large social trail created by Park staff and visitors behind the Steel VC (left) and another one in front (right). Photos by Carrie Wyler.

Figure 14. Fencing in front of the Rim Village Café and Gifts building to protect revegetation sites in heavily trafficked areas. Photo by Carrie Wyler.

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Appendix A

Plant taxa listed on 1935 Planting Plan (list has been updated with confirmed/corrected plant species names).

Trees

Abies lasiocarpa var. *lasiocarpa*, subalpine fir
Abies magnifica x *Abies shastensis*, Shasta red fir
Tsuga mertensiana, mountain hemlock

Shrubs

Acer glabrum, Torrey's maple
Amelanchier alnifolia, Saskatoon serviceberry
Ceanothus prostratatus, Mahala mat
Holodiscus microphyllus var. *glabrescens,* bush ocean spray
Kalmia microphylla, alpine laurel
Lonicera conjugialis, purple flower honeysuckle
Lonicera involocrata var. *involucrata*, black twinberry
Salix, willow
Sambucus racemosa var. *arborescens*, Pacific red elderberry
Spirea splendens, subalpine spirea
Sorbus scopulina, Greene's mountain ash
Vaccinium scoparium, grouseberry
Rhamnus purshiana, cascara

Perennials

Phlox diffusa, spreading phlox
Dicentra formosa ssp. *formosa*, Pacific bleeding heart
Aconogonon davisiae var. *davisiae*, Davis's knotweed
Lupinus albicaulis var. *shastensis,* Pine lupine

Additional Vegetation Transplanted 1930-1937

Aquilegia formosa, red columbine
Castilleja species, paintbrush
Erigeron glacialis var. *glacialis*, peregrine fleabane
Veratrum viride var. *eschscholzianum*, green false-hellebore
Juncus species, rushes
Lonicera conjugialis, purple-flower honeysuckle
Polemonium species, Jacobs ladder
Valeriana sitchensis var. *sitchensis*, mountain heliotrope
Ribes erythrocarpum, Crater Lake current
Salix, willow
Carex species, sedges
Arctostaphylos nevadensis, pinemat manzanita

Appendix B

Plant taxa list for the Steel VC area.

Scientific Name	Common Name
Acer glabrum var. *torreyi*	Rocky Mountain maple
Agoseris aurantiaca var. *aurantiaca*	Orange agoseris
Amelanchier alnifolia	Saskatoon serviceberry
Anaphalis margaritacea	Pearly everlasting
Aquilegia formosa	Red columbine
Bromus sitchensis var. *carinatus*	California brome
Calamagrostis rubescens	Pinegrass
Calyptridium umbellatum	Pussypaws
Carex preslii	Presl's sedge
Carex spectabilis	Showy sedge
Carex straminiformis	Shasta sedge
Chamaenerion angustifolium var. *canescens*	Fireweed
Cinna latifolia	Slender woodreed
Danthonia intermedia	Timber oatgrass
Dicentra formosa ssp. *formosa*	Pacific bleeding heart
Dicentra uniflora	One flowered dicentra
Elymus elymoides ssp. *elymoides*	Common squirreltail
Elymus glaucus ssp. *glaucus*	Blue wildrye
Ericameria greenei	Greene's goldenweed
Erigeron glacialis var. *glacialis*	Peregrine fleabane
Eriocoma occidentalis	Western needlegrass
Eriogonum marifolium var. *marifolium*	Sierra eriogonum
Erythranthe lewisii	Great purple monkeyflower
Eucephalus ledophyllus	Cascade aster
Gayophytum diffusum ssp. *parviflorum*	Nuttall's groundsmoke
Juncus drummondii	Drummond's rush
Ligusticum grayi	Gray's licorice root
Lonicera involucrata var. *involucrata*	Black twinberry
Lupinus albicaulis var. shastensis	Pine lupine
Mitella breweri	Brewer's mitrewort
Nothocalais alpestris	Alpine lake false dandelion
Osmorhiza purpurea	Purple sweet cicely
Penstemon rydbergii var. *oreocharis*	Rydberg's penstemon
Phacelia mutabilis	Changeable phacelia

Scientific Name	Common Name
Phleum alpinum	Alpine timothy
Phlox diffusa	Spreading phlox
*Poa compressa**	Canada bluegrass
*Poa pratensis**	Common Kentucky bluegrass
Polygonum aviculare ssp. *depressum**	Common knotweed
Ribes cereum var. *cereum*	Wax currant
Ribes viscosissimum	Sticky currant
*Rumex acetosella**	Sheep sorrel
Salix commutata	Undergreen willow
Sambucus racemosa var. *arborescens*	Red elderberry
Senecio triangularis var. *triangularis*	Arrowleaf groundsel
Solidago elongata	Narrow goldenrod
Sorbus scopulina	Greene's mountain ash
*Spergularia rubra**	Red sand-spurrey
Spiraea splendens	Subalpine spiraea
*Taraxacum officinale**	Common dandelion
Trifolium longipes var. *hanseni*	Hansen's clover
Turritis glabra	Tower mustard
Valeriana sitchensis var. *sitchensis*	Mountain heliotrope
Veratrum viride var. *eschscholzianum*	Green false-hellebore
Viola glabella	Pioneer violet

*Non-native plant species

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

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Crater Lake National Park
P.O. Box 7
Crater Lake, Oregon 97604