National Park Service
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Crater Lake National Park

Steel Visitor Center Rehabilitation Revegetation Project

2020 Annual Report

ON THIS PAGE
Steel Visitor Center, summer 2020.
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

2020 Annual Report

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All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

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Abstract

Crater Lake National Park's Steel Visitor Center is slated for a major rehabilitation project in 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 2020 field season included site documentation and planning, collecting seed from 34 different plant species, salvaging 222 pots of plants, and seeding just under 3,500 pots for propagation. The project area was surveyed for invasive plants and 6,674 were found and treated. Revegetation work is planned to continue into the 2021 season by expanding and increasing seed collection efforts, caring for propagated and salvaged plants, and continuing to survey for and treat 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 Delacey Randall, Hamilton Hasty, Eleanor Roeder, Shaina Nicassio, and Shane Palmer. 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. Steve Mark assisted with identifying Foundation Plantings and providing historic photos of the Steel Visitor Center landscape.

Introduction

Crater Lake National Park's (CRLA) Steel Visitor Center (VC) located in Munson Valley's Historic District (Figure 1) is the "gateway" 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.

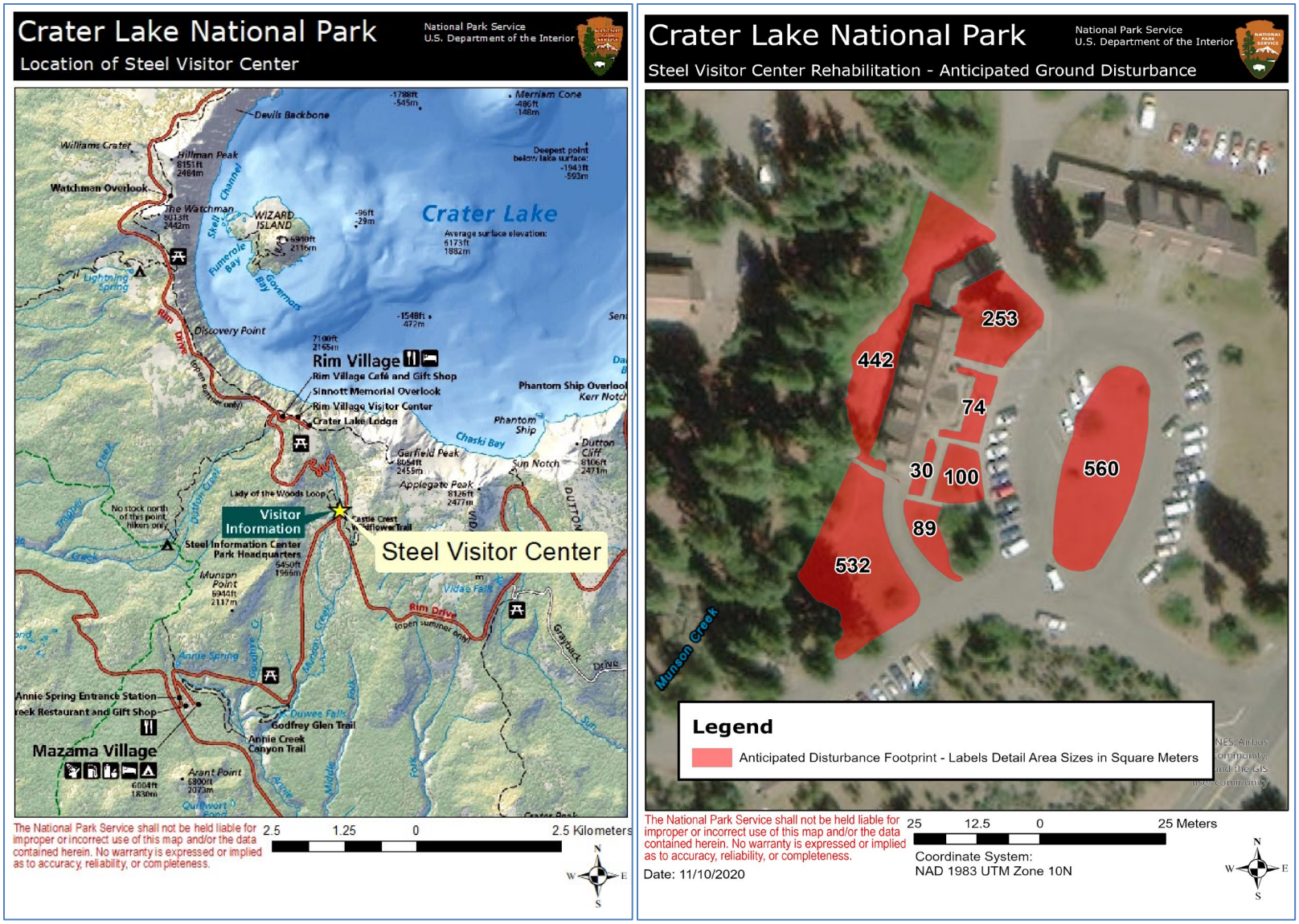

Figure 1. Location of the Steel Visitor Center within the Park (left). Anticipated disturbance areas (highlighted in red) at the Steel Visitor Center (right). Maps by Scott Heisler.

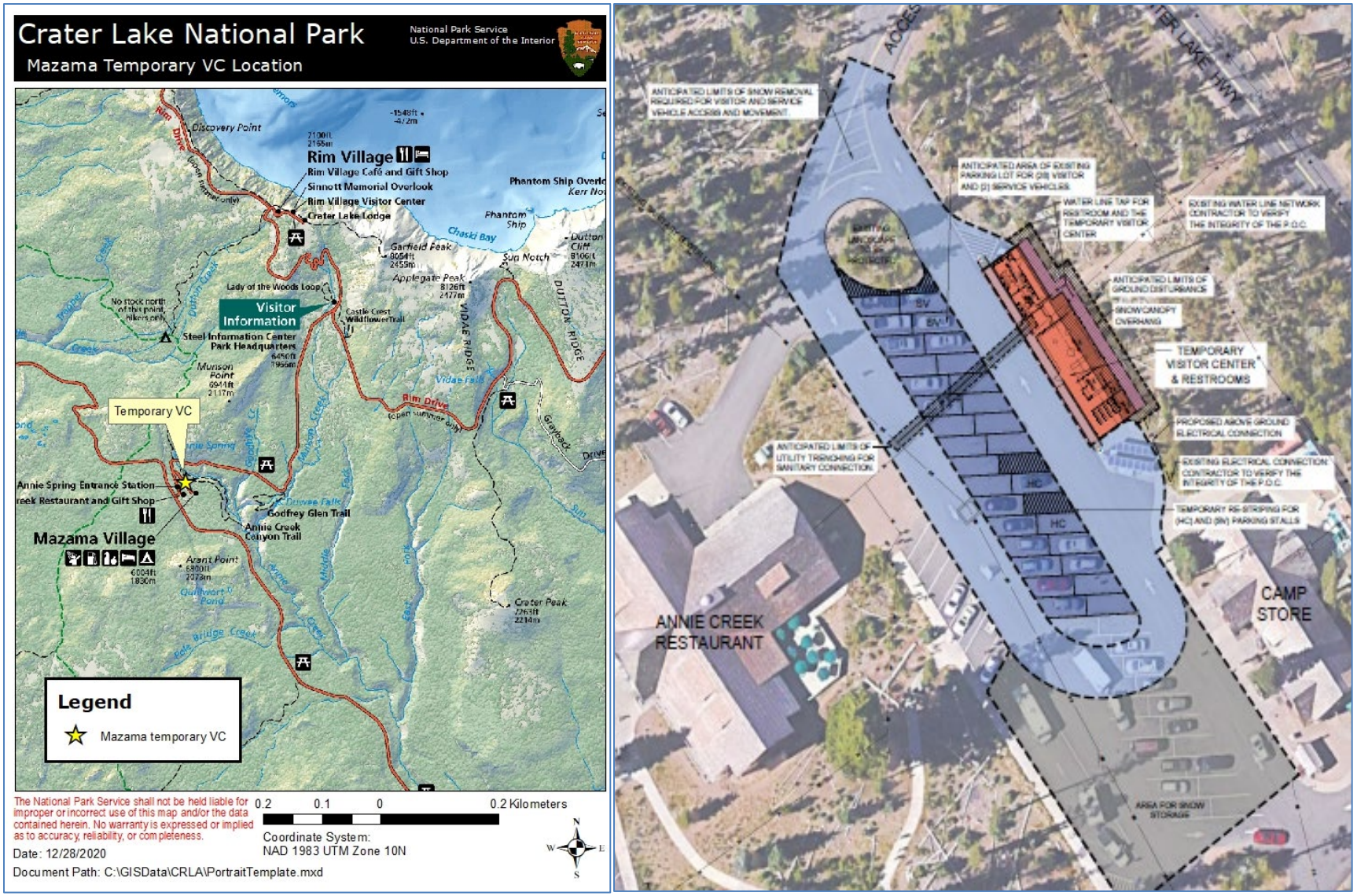

Figure 2. Location of the Temporary VC in Mazama Village (left). Map by Carrie Wyler. Drawing of the Temporary VC facilities (red and purple shading) near the Mazama Village Camper Store (right). Image provided by the Denver Service Center.

5. Restoring affected areas through site preparation, planting, and seeding.

6. Monitoring restored areas for revegetation efficacy and augmenting restoration actions.

Construction on the project is scheduled to begin during 2021; exploratory demolition was conducted on the Steel VC stone walls in August of 2020. Field work in association with this project in 2020 was performed by seasonal Biological Science Technicians from May 26th to October 29th. The Covid-19 pandemic affected scheduled work by preventing the Botany program from hiring a full staff due to caps on the number of people permitted in employee housing. This resulted in lower amounts of plant materials and seed gathered and will need to be compensated for in future years.

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 3).

Figure 3. Trampled areas adjacent to high traffic pathways in front of the Steel VC, showing compacted soil devoid of vegetation. Photo by Carrie Wyler.

The Botany program's 2020 work progress 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.

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.

It was determined that three site prescriptions would adequately reflect the diversity of the project areas: Steel VC south- and east-facing sunnier areas; Steel VC shadier west-facing areas; and the Temporary VC site at Mazama Village. Prescriptions were developed by recording habitat characteristics, dominant plant species, and ocular estimates of each species' relative cover. Photo points were established, and photos were taken to document the pre-disturbance site conditions. Unique vegetation communities and microhabitats were also documented within the project areas. If unplanned disturbance areas arise, previously developed prescriptions will either be extended to these new areas, if applicable, or a new prescription will be formulated based upon a representative undisturbed area. Further information on the specifics of the process can be found in Gregory et al. (2015).

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 during the 2020 field season for the Steel VC, and Table 2 lists all species collected for the Temporary VC area. In anticipation of this project, limited seed collection was conducted during the 2019 field season 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 collected ideally 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 2020 and future collection years.

Table 1. Seed collection list for the Steel VC.

Scientific Name	Common Name
Agoseris aurantiaca var. *aurantiaca*	Orange agoseris
Anaphalis margaritacea	Pearly everlasting
Aquilegia formosa	Red columbine

Scientific Name	Common Name
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
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 goldenbush
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
Ligusticum grayi	Gray's licorice-root
Lonicera involucrata var. *involucrata*	Black twinberry
Lupinus albicaulis var. *shastensis*	Pine lupine
Nothocalais alpestris	Alpine lake false dandelion
Penstemon rydbergii var. *oreocharis*	Rydberg's penstemon
Phacelia mutabilis	Changeable phacelia
Phlox diffusa	Spreading phlox
Ribes cereum var. *cereum*	Wax currant
Ribes viscosissimum	Sticky currant
*Salix commutata**	Undergreen willow
Sambucus racemosa var. *arborescens**	Pacific red elderberry
Senecio triangularis	Arrowleaf groundsel
Solidago elongata	Narrow goldenrod
*Sorbus scopulina**	Greene’s mountain ash
Spiraea splendens	Subalpine spiraea
Turritis glabra	Tower mustard
Valeriana sitchensis ssp. *sitchensis*	Mountain heliotrope
Veratrum viride var. *eschscholzianum*	Green false-hellebore

*Cuttings were taken of these species.

Table 2. Seed collection list for the Temporary VC.

Scientific Name	Common Name
Agoseris species	Agoseris
Calyptridium umbellatum	Pussypaws
Carex halliana	Hall's sedge
Carex inops ssp. *inops*	Long-rhizome sedge
Carex pachycarpa	Many-rib sedge
Elymus elymoides ssp. *elymoides*	Common squirreltail
Eriocoma occidentalis	Western needlegrass
Lupinus albicaulis var. *shastensis*	Pine lupine
Lupinus lepidus var. *lobbii*	Prostrate lupine

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 Nine Stall garage at Park headquarters (Figure 4). 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.

Prior to shipping seed to the DGRC, all seeds from a single species were combined into doubled paper bags; each bag was labeled with species code, seed zone, and project name; and the bags were taped shut. Records were kept of boxes shipped and their contents. Shipping seeds throughout the growing season was crucial due to the shortage of seed storage space at the Park, and inadequate ventilation for effective drying of damp material.

Figure 4. 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 Foundation Plantings or other plants were salvaged from the Temporary VC site.

Salvage of Foundation Plantings was conducted in October 2020, as late into the progression to winter dormancy as weather and the field season allowed (Figure 5). 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 5. 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 (i.e., east and south of the Steel VC in sunny areas; west of the Steel VC in shadier or wetter areas), and 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 will be overwintered and cared for at the nursery until outplanted at project completion (Figure 6). The specifics of this care are detailed in established Botany program nursery protocols on file at CRLA.

Figure 6. Shadehouse at the Ball Diamond nursery where salvaged plants will be 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

Choice of plant species selected for propagation was based on past success with propagation at the park, Foundation Planting species, 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 cuttings will be produced by the DGRC in Cottage Grove, Oregon.

Invasive Vegetation Management

In 2020, project areas were 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 7) 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 7. Signage notifying the public of an herbicide application 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. Table 3 shows one of the completed site prescription forms; remaining forms are listed in Appendix B. A full list of all plant taxa identified on site can be found in Appendix C.

Table 3. One of two site prescription forms for the Steel VC.

Seed Zone: Steel VC east/south	**Location ID: Steel** VC	**Planned site**
Location: Visitor Center east (front) of building and southern side.		
Site Description: Area around Steel VC and all surrounding vegetation. Front, back, and sides are presumed to be disturbed by construction work being done on the VC building.		
Pre-Disturbance Site Information		
Plant Species	**Common Name**	**Relative % Cover**
Calyptridium umbellatum	Pussypaws	2%
Carex species, see Appendix C	Sedges	15%
Eucephalus ledophyllus	Cascade aster	3%
Gayophytum diffusum ssp. *parviflorum*	Nuttall's groundsmoke	5%
Grass species, see Appendix C	Grasses	15%
Penstemon rydbergii var. *oreocharis*	Rydberg's penstemon	32%
Ribes viscosissimum	Sticky currant	3%
Solidago elongata	Narrow goldenrod	2%
Sorbus scopulina	Greene's mountain ash	15%
Other		5%
	Total Cover:	100%
Associated species: See Appendix C for complete species list		
UTM (Zone 10, NAD 83):	Beginning: 0570682 E Beginning: 0570689 E	End: 4749688 N End: 4749771 N
Total Vegetative Cover: 75%		**Elevation:** 6680 ft.
Slope: < 10%	**Aspect**: south and east	**Snowmelt out:** early June
Soil "hardness," presence of rocks: Very compacted in some areas		
General Soil description: Pumice 2: fine ash, gravely, 6: sand, gravely		
Ameliorating microsite features: 1: existing vegetation, 5: fine organic debris		
Wind exposure: Low	**Canopy cover**: Low	
Area: 1,078 m^2 (plus another 560m^2 if the parking circle island is used for staging and disturbed)		
Comments: Invasive plants present: Red sand-spurrey (*Spergularia rubra*); Canada bluegrass (*Poa compressa*); common Kentucky bluegrass (*Poa pratensis);* sheep sorrel *(Rumex acetosella)*; common knotweed *(Polygonum aviculare* ssp. *depressum)*; bitter winter cress (*Barbarea vulgaris)*		
Date for Site Restoration to begin: Fall 2021		
Description of Site Disturbance for Restoration need: TBD		
Recorders: CW, SH	**Date:** 7/14/20	

Seed Collection

Plant phenology was observed from July 6 to October 30 (snow-free dates at Park headquarters were June 20 to November 5) during the 2020 field season. Initial 2020 seed collection began in late August and continued through the end of October. The peak seed collection for most plant species occurred from early-August to mid-September (Table 4).

Table 4. 2020 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											
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 2020 seed collection. Quantities of seed collected in 2019 and 2020 are listed in Table 5. The majority of seed collected during 2020 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 5. Seed collection quantities from 2019 and 2020.

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

Foundation Planting Salvage

In total, 222 containers of salvaged plants were collected from around the Steel VC (Figure 8). The quantities of each pot size from the two seed zones are listed in Table 6.

Table 6. Quantities of plants salvaged on 10.14.2020 from the Steel VC.

Salvage Location (Seed Zone)	Pot size	Quantity
East and South of the VC in sunny areas	1 gallon	57
East and South of the VC in sunny areas	3 gallons	11
East and South of the VC in sunny areas	8 gallons	1
West of the VC or shadier or wetter areas	1 gallon	133
West of the VC or shadier or wetter areas	3 gallons	15

Salvage Location (Seed Zone)	Pot size	Quantity
West of the VC or shadier or wetter areas	5 gallons	2
West of the VC or shadier or wetter areas	flats of moss	3
	TOTAL	**222**

Figure 8. Salvaged plants at the Steel VC (left) and at the Ball Diamond nursery (right). Photos by Carrie Wyler.

Plant Material Propagation

Seventeen plant species were targeted for plant propagation efforts in 2020 (Table 7). At CRLA, a total of 2,006 pots were seeded in November of 2020 and are presently in cold stratification under the snowpack at the Ball Diamond nursery (Figure 9). Eight plant species will be propagated at the DGRC: five from seed and three from cuttings. Germination and rooting success will be evaluated during the 2021 field season.

Table 7. Number of plants being propagated at CRLA and the DGRC as of fall 2020 for the Steel VC Rehabilitation project.

Scientific Name	Quantity	Location of propagation
Eriocoma occidentalis	490	CRLA
Bromus sitchensis var. *carinatus*	196	CRLA
Carex species mix	784	DGRC
Dicentra formosa ssp. *formosa*	50	DGRC
Elymus elymoides ssp. *elymoides*	98	CRLA
Elymus glaucus ssp. *glaucus*	196	CRLA
Ericameria greenei	196	DGRC

Scientific Name	Quantity	Location of propagation
Eucephalus ledophyllus	294	DGRC
Lonicera involucrata var. *involucrata*	46	CRLA
Penstemon rydbergii var. *oreocharis*	490	CRLA
Phacelia mutabilis	98	CRLA
Ribes species	98	CRLA
Riparian grass mix	196	CRLA
*Salix commutata**	20	DGRC
Sambucus racemosa var. *arborescens**	20	DGRC
*Sorbus scopulina**	40	DGRC
Spiraea splendens	50	DGRC
TOTAL	3,460	

*Propagation via cuttings instead of seed.

Figure 9. 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 6,674 invasive plants were encountered and treated in the Steel VC project area during the 2020 season. No invasive plant species were encountered at the Temporary VC site. A map of invasive plant populations around the Steel VC is displayed in Figure 10. 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.

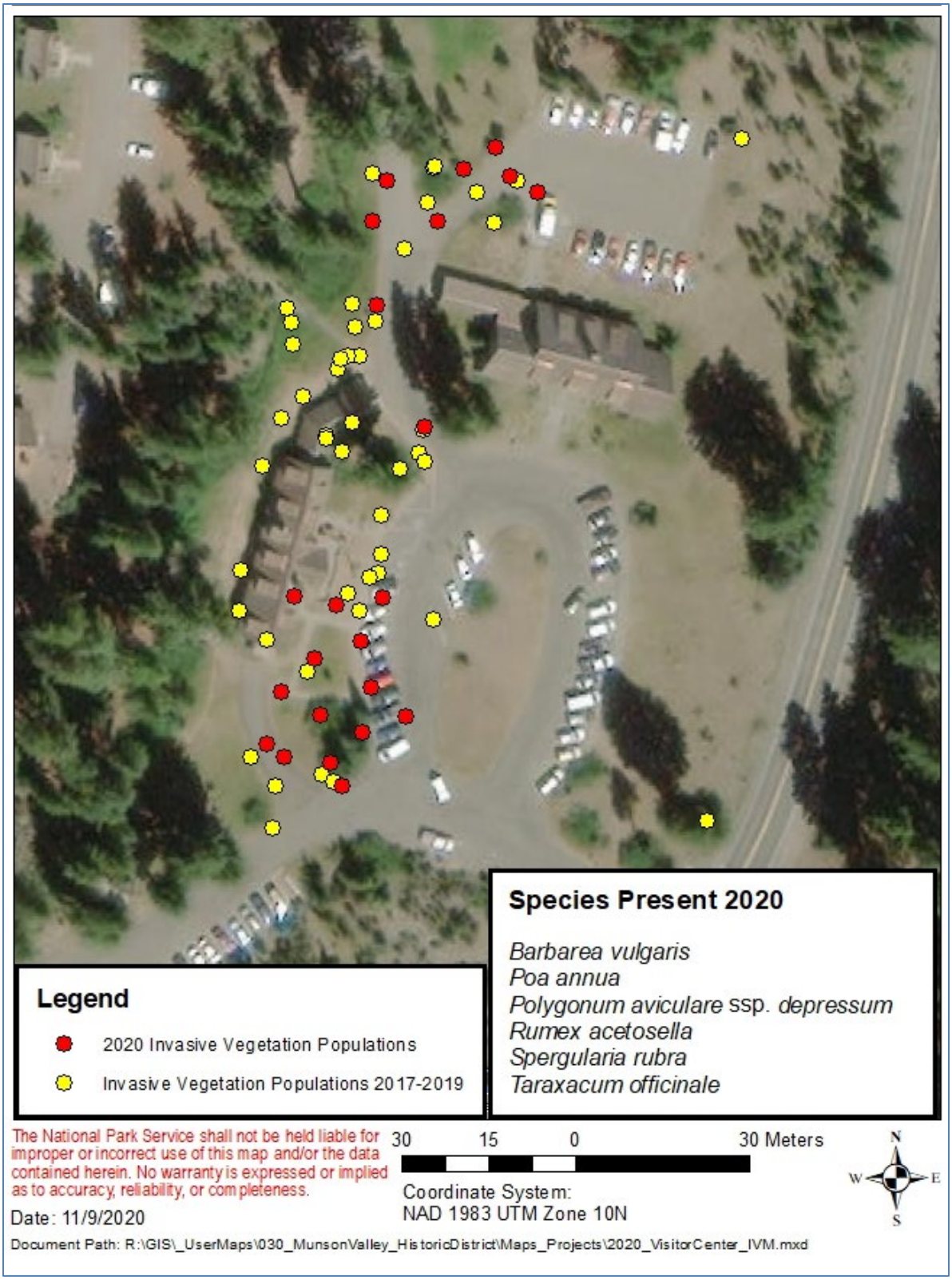

Figure 10. Current and historic invasive plant populations at the Steel VC. Map by Scott Heisler.

A list of invasive plant species treated at the Steel VC can be found in Table 8.

Table 8. Abundance (number of individual plants) of treated invasive plants within the Steel VC project area for 2020.

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

Discussion

As construction commences in 2021, revegetation work will focus on seed collection, care of propagated and salvaged plants, surveying for and controlling invasive plants, and monitoring the area for additional, unplanned disturbance.

Recommendations and needs for Steel VC Rehabilitation Revegetation Project in the 2021 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.
- Plants propagated at the DGRC will need to be retrieved, acclimated to the area, and cared for until planting commences.
- 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 11). 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 12).

- Fencing will need to be procured early in the 2021 season, so materials are available as needed in late 2021 and early 2022. Fence post receivers should be installed in fall 2021 to facilitate fencing installation come snowmelt in 2022.

Figure 11. 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 12. Fencing at Rim Village Café to protect revegetation sites in heavily trampled areas. Photo by Carrie Wyler.

Literature Cited

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Appendix A

Plant Materials 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

Second site prescription for the Steel VC.

Seed Zone: Steel VC (west-facing)	**Location ID:** Steel VC	**Planned site**
Location: Steel Visitor Center west (rear) of building		
Site Description: Area behind main VC including west-facing shadier/moister sites between the building and the creek.		
Pre-Disturbance Site Information		
Plant Species	**Common Name**	**Relative % Cover**
Carex species, see attached list	Sedges	20%
Eucephalus ledophyllus	Cascade aster	2%
Gayophytum diffusum ssp. *parviflorum*	Nuttall's groundsmoke	1%
Grass species, see attached list	Grasses	20%
Penstemon rydbergii var. *oreocharis*	Rydberg's penstemon	5%
Salix commutata	Undergreen willow	30%
Solidago elongata	Narrow goldenrod	2%
Other		20%
	Total Cover:	100%
Associated species: See Appendix C for plant taxa list		
UTM (Zone 10, NAD 83):	Beginning: 0570682 E Beginning: 0570689E	End: 4749688 N End: 4749771N
Total Vegetative Cover: 75%		**Elevation**: 6,680 ft.
Slope: < 10%	**Aspect:** west	**Snowmelt out**: early June
Soil "hardness," presence of rocks: Very compacted in some areas		
General Soil description: Pumice 2: fine ash, gravely, 6: sand, gravely		
Ameliorating microsite features: 1: existing vegetation, 5: fine organic debris; back of building provides shade and is in close proximity to Munson creek.		
Wind exposure: Low	**Canopy cover (overall):** Medium	
Area: 442m^2		
Comments: Invasive plant species present: red sand-spurrey (*Spergularia rubra);* Canada bluegrass (*Poa compressa);* common Kentucky bluegrass (*Poa pratensis)*; sheep sorrel (*Rumex acetosella);* common knotweed (*Polygonum aviculare* ssp. *depressum);* bitter winter cress (*Barbarea vulgaris)*		
Date for Site Restoration to begin: Fall 2021		
Description of Site Disturbance for Restoration need: TBD		
Recorders: CW, SH	**Date:** 7/14/20	

Site prescription for the Temporary VC.

Seed Zone: Mazama	**Location ID:** Temporary VC	**Planned site**
Location: Mazama Village Camper Store parking lot		
Site Description: Temporary facilities to support the rehabilitation of the Steel VC until construction is completed (see Figure B-1)		
Pre-Disturbance Site Information		
Scientific Name	**Common Name**	**Relative % Cover**
Elymus elymoides ssp. *elymoides*	Common squirreltail	5%
Eriocoma occidentalis	Western needlegrass	5%
Carex species (*C. pachycarpa, C. halliana, C. inops)*	Sedges	35%
Calyptridium umbellatum	Pussypaws	3%
Lupinus albicaulis var. *shastensis*	Pine lupine	1%
Lupinus lepidus var. *lobbii*	Prostrate lupine	3%
Agoseris species	Agoseris	1%
Conifers	Conifers	45%
Other		2%
	Total Cover:	100%
Associated species:		
UTM (Zone 10, NAD 83):	0568040 E	4746514N
Total Vegetative Cover: 70%		Elevation: 6,027 ft
Slope: < 5%	Aspect: West	Snowmelt out: Early June
Soil "hardness," presence of rocks: Area on edge of parking lot is compacted.		
General Soil description: Sand, loamy		
Ameliorating microsite features: Existing vegetation, fine organic debris, coarse woody debris, and gravel.		
Wind exposure: Low	Canopy cover (overall): Medium	
Area: Unknown until structures are put in place and visitor traffic flow established		
Comments:		
Date for Site Restoration to begin: Fall 2021 or 2022		
Description of Site Disturbance for Restoration need:		
Recorder: CW	**Date:** 8/2020	

Figure B-1. Mockup drawing of the temporary VC mobile unit structure at Mazama parking lot. Courtesy of the Denver Service Center.

Appendix C

2020 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	Western 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	Tmber oatgrass
Dicentra formosa ssp. *formosa*	Bleedingheart
Dicentra uniflora	Steer's head
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	Lewis' 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

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

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