Arana Gulch Habitat Management Plan
City of Santa Cruz

Year 11 (2024) Annual Report

CDFW Permit No. 2081 (a)-13-013-RP
CDFW Permit No. 2081 (a)-18-016-RP
Coastal Development Permit No. 3-11-074 (Arana Gulch)

February 13, 2025

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1. Executive Summary

This monitoring report evaluates the City's progress implementing the Arana Gulch Habitat Management Plan (HMP). The HMP guides the long-term restoration of the 67-acre Arana Gulch Open Space. The plan provides management goals and objectives to enhance three specific management areas: Hagemann Gulch Riparian Woodland Management Area, Arana Creek Wetland and Riparian Management Area and the Coastal Prairie/Tarplant Management Area.

The HMP was developed as part of the California Coastal Commission's (CCC) Coastal Development Permit process for the adoption of the Arana Gulch Master Plan (Master Plan). The Master Plan includes management guidelines for access, resource management, and education. Since Arana Gulch lies within the CCC's Coastal Zone, a permit was necessary to implement the Master Plan. The CCC conditionally approved the permit on December 8, 2011. Special permit conditions required, among other things, developing and implementing an HMP, establishing a technical advisory group to advise the City on habitat management actions, and submitting annual monitoring reports to document compliance with the HMP.

The City finalized and began implementing the HMP in 2013. A technical advisory group was formed, the Adaptive Management Working Group (AMWG). Actions outlined in the HMP were initiated in 2013 and 2014 and continues to the present; these actions are described in the Year 1 (2014), Year 2 (2015), Year 3 (2016), Year 4 (2017), Year 5 (2018), Year 6 (2019), Year 7 (2020), Year 8 (2021), Year 9 (2022), and Year 10 (2023) Annual Reports. Actions implemented in Year 11 (2024) are described in this report. The AMWG provided input to the City during the implementation of the Year 11 activities.

The purpose of this annual report is to describe the current condition of the Arana Gulch habitat areas, evaluate the performance of each area in relation to the performance standards outlined in the HMP and included in the CDP, and provide management recommendations for the following year to ensure progress toward and achievement of success criteria. In Year 11 (2024), the City continued to focus on improving the habitat and population of the Santa Cruz tarplant (SCT), a federally Threatened and a California State Endangered species. The City continued seasonal cattle grazing and continued to implement management to control invasive weeds from the prairie/tarplant management area. A 4th year of experimental outplantings of SCT (i.e., translocation of greenhouse-grown plants to an outdoor location) was conducted in February and the plantings were monitored for survival and seed production. The plants were propagated from seed collected on-site in summer 2018 under an agreement between the City and the University of California, Santa Cruz (UCSC). Other actions included seasonal mowing of non-grazed grassland. Continued removal/control of invasive non-native plant species from habitat areas, and removal/cleanup of transient encampments from the Arana Creek management area. All of the actions taken by the City are to continue progress to meet the HMP objectives.

AMWG coordination activities included two field meetings (May and September), as well as email correspondence.

The habitat management activities undertaken in 2024 are summarized below.

Master Plan Improvements

In 2024 the City continued to maintain the Coastal Prairie Loop Trail, the Arana Gulch Multi-Use Trail, and the Agnes Street Connector Trail. Trail construction over Hagemann Gulch and Arana Creek affected riparian woodland and in 2014 the City prepared a revegetation plan pursuant to a CDFW Streambed Alteration Agreement. Revegetation at/around Arana Creek was installed in January and February 2015 by City staff and volunteers; additional plants were installed in February 2016. In 2020 oak tree plantings were installed in this area as part of an Urban Tree Inventory and Planting Project. In 2024, the City built a new split rail fence along a portion of the Marsh Vista Trail to deter campers from inhabiting the riparian wetlands. The harbor entrance/exit trail area was rehabilitated with improvements to the decomposed granite pathway, drainage and a new retaining wall.

Summary of Coastal Prairie/Santa Cruz Tarplant Management Area Activities

Management actions in Year 11 included outplanting of SCT, a census of SCT, grazing, seasonal mowing, invasive plant control, and monitoring.

SCT Outplanting. A 4th year of SCT outplantings was conducted in February; 784 SCT plants were installed in Area A Southeast (within 10 plots) and 334 SCT plants were installed in a cattle exclusure in Area C (within 5 plots). Each outplanting plot was mulched with wood chips and was hand-weeded once in March/April. By September, there were 705 outplantings alive in Area A (90% survival rate) and 302 outplantings alive in Area C (90% survival rate). The high survival rate (90%) is similar to the survival rate of the 2023 outplants. It was an improvement over the 2022 outplantings, wherein plant survival was only 20% and an improvement from the 65% survival of the 2021 planting. The high survival rate is likely attributed to the two above-average rainfall seasons, compared to drought conditions in both 2021 and 2022. Some herbivory by gophers was observed in 2024, yet visual observations found damage was light (i.e., less than 10 plants).

SCT Census. A census of SCT was conducted in late spring, summer, and early fall 2024. Approximately 4,141 SCT were found on site; 3,839 with Area A and 302 in Area C. This is an increase from 1,899 SCT plants in 2023. Within Area A, 705 of the SCT were from the February 2024 outplantings; the remainder of the SCT (3,134) were natural recruits within previous outplanting plots. The areas subject to previous year SCT outplanting were monitored for SCT recruitment (i.e., F_1, F^2_2, and F_3 generations). All the natural recruits were located within Area A, with most observed within previous year outplanting plots where the plants grew from SCT seed naturally broadcast by the survivors of these outplantings, representing a F_1 generation. Most plants recruited into previous woodchip mulched plots. There was just one SCT observed outside of the 2023 plots and could be an F_2 or F_3

generation. Most of the plants were small, single stem plants with only 3-8 flowerheads each; however, two plots supported well-developed and branched plants, averaging 15-20 inches in height and 14-20 flowerheads per plant. The 2024 SCT outplantings in Area A and Area C were multi-branched, averaging 15 inches in height and supported 30 flowerheads per plant. For 2024, the SCT plants produced an estimated 49,154 flowerheads. Approximately 40,094 were produced in Area A and approximately 9,060 were produced in Area C.

Increasing the SCT population to above the 2006 population level of 267 plants[1] is an HMP goal. This goal was met in 2024. There was a sufficient number of SCT plants to allow collection of SCT seed (minimum of 50 plants is required as per CDFW agreement) and UCSC conducted seed collection in fall 2024. In October the City entered into an agreement with UCSC Greenhouses to propagate approximately 1,000 SCT plants for outplanting in 2025.

Grazing and Mowing Program. Under the guidance of the Stocking and Work Program prepared in 2014, the City continued to contract with a local rancher for seasonal grazing within the northern portion of Area A and Areas C and D; grazing (cow/calf) was initiated on January 1 and continued all year (through December 31). 2024 was the 10th season of grazing (grazing was initiated in winter/spring 2015). Cows began grazing Area A Southwest when rains commenced in late November 2024 for SCT management purposes. In addition, cows were allowed to graze the Area C cattle exclosure for SCT management purposes. With the exception of a short-duration grazing session in Area A Southwest in January/February 2024, this was the 4th year cattle were excluded from the southern part of Area A. Grassland management was focused on periodic spring and summer season mowing in Area A Southwest and Southeast, with the objective to keep canopy height at/below 8-10 inches. Mowing was conducted in April, May, and July. Additional activities in the management area included monitoring plant composition, plant cover, canopy height, and residual dry matter (RDM), implementing removal/control of invasive weed infestations, and documenting site conditions at previously established permanent photo stations.

As per guidelines in the HMP, seasonal mowing was conducted in May for grassland/prairie areas located outside the grazing fences. Mowing was conducted to reduce the canopy height of the non-native grasses and forbs to benefit the coastal prairie species diversity and habitat function. A rotary mower was used. Area B was weed whipped in June. Bird surveys were completed prior to mowing and no nests were observed. Colonies of native grasses and forbs were flagged and were not mowed. Blue bird nest boxes installed in 2018 continue to be used by this species.

To facilitate SCT seed dispersal and to aid in grassland management, the Area A south and the SCT enclosure (cattle exclusure) in Area C were subject to a fall season program of selective mowing and grazing. In mid-September the cattle exclosure fence in Area C was

[1] See Section 3.3, Page 52 of Arana Gulch HMP

opened and cattle were allowed to graze the grass and SCT outplantings. In mid-November, grazing was allowed in Area A, North and Area A Southwest. Molasses barrels were placed in the Area A Southwest in December 2024 to encourage grazing activity. Also, in December hand-collected SCT seed from Area A Southeast was hand-broadcast onto the grazed area in Area A Southwest.

Invasive Plant Control. In compliance with the HMP and an Invasive Weed Work Plan (IWWP) prepared for the management area, City staff, volunteers from the Santa Cruz Museum of Natural History Earth Stewards Project, the Volunteer Center of Santa Cruz County's Youth SERVE Summer Institute, removed occurrences of invasive, non-native plant species (i.e., thistles, cotoneaster, and Himalaya berry) from the central prairie/grassland.

Monitoring. Grassland site conditions and photo-monitoring of permanent points were documented in April. Canopy heights were measured in February, April, and December. RDM measurements were obtained in October and bare ground/plant cover with SCT-occupied areas was recorded in December. The 2023/24 water year was an above-average rainfall season (34.86 inches), which followed an above-average year after three consecutive years of below average rainfall.

Summary of Hagemann Gulch Riparian Woodland and Arana Gulch Creek Riparian Woodland and Wetland Areas Activities

The City continued to observe and manage activities within these two management areas. In 2024, actions were focused on public safety, vegetation management for fire safety, removal/control of transient encampments, and control/removal of invasive plant species. In December, the City removed ivy from the oak trees along the Marsh Vista Trail.

The City continued to implement clean-ups from illegal camping activities, such as removing trash and waste from the northernmost portion of the Arana Gulch Creek woodland areas.

Management Activities Proposed for 2025 (Year 12)

The following management actions are identified for 2025:

- Implement periodic seasonal mowing (rotary mower) in Area A Southwest and Southeast to keep canopy height below 8-10 inches, removing seed heads of non-native grasses.
- Implement seasonal grazing in Area A Southwest to keep canopy height below 8-10 inches and create bare ground to aid in SCT seed dispersal. Monitor effects of cattle grazing on plant cover and SCT recruitment; remove cattle when SCT plants begin to bolt and/or when they may be significantly affected by browse.
- Implement experimental strip of flail mowing in Area A Southeast. Monitor plant cover and compare to rotary mowed areas.
- Continue monitoring plant composition and plant cover, and implement removal/control of invasive weed infestations. Within SCT-occupied areas, monitor

the amount of bare ground present in December, which coincides with the germination period of SCT.

- Conduct outplanting of SCT container-grown plants in January/February and monitor for survival and seed productivity in the summer/fall.
- Install interpretative signage with information on the SCT planting program at the cattle exclosure in Area C.
- Continue seasonal cattle grazing within the northern portion of Area A and Areas C and D, as per the approved grazing contract and Stocking and Work Program. Additional activities in these two management areas include monitoring plant composition, plant cover, and residual dry matter (RDM), removal/control of invasive weed infestations, and documenting site conditions at the permanent photo stations. Monitor SCT expression at the previous outplanting sites.
- Consider implementing interim grassland management actions in Areas A, C and D (i.e., focused mowing or other management) if cattle grazing is delayed and canopy height levels are above the target objective of 2-3 inches (5-8 cm) between the months of November thru April.
- Within the boundaries of the prairie/SCT management area, designated woody plants growing outside of the grazing area, yet within the designated grassland, will continue to be removed and herbicide treatment may need to be applied, if needed to control stump sprouting. Continual treatments will need to be planned and implemented to keep woody plants from encroaching into the prairie.
- Conduct a census for SCT in summer and early fall 2025; if feasible, document SCT occurring in previous year plots to evaluate natural plant recovery. Seed collection of SCT may be done if more than 50 SCT are present, pending prior approval from CDFW.
- Continue relationship with UCSC Greenhouses for seed storage, seed increase and plant propagules.
- Continue to implement management actions within the Arana Gulch Creek Management Area. Pending funding and staff availability, the City will continue to implement management actions within the Hagemann Gulch Management Area.
- Continue to work with the AMWG to form recommendations for improving trail sections to improve walkability and deter new trails from forming.
- Coordinate with the Resource Conservation District (RCD) on Arana Creek watershed management, including measures to reduce erosion and sediment entry into the watershed, if opportunities arise.
- Continue to confer with the AMWG on adaptive habitat management activities in 2025 through periodic meetings and group email correspondence.
- Continue to coordinate with environmental groups, such as the Natural History Museum, Watershed Stewards Program, and others, as opportunities arise.
- Re-organize City's Arana Gulch Habitat Management website to provide clearer access to pertinent information.

2. Introduction

2.1 Background

Arana Gulch is 67 acres of open space owned by and located within the City of Santa Cruz. The eastern half of the property features the riparian corridor of Arana Gulch Creek and a tidal wetland where the creek drains into Monterey Bay at the Santa Cruz Harbor. The western half is remnant coastal prairie grassland that supports the Santa Cruz tarplant, a federally Threatened and a California State Endangered species. A steep and narrow intermittent drainage called Hagemann Gulch crosses the property on the western boundary. The features of the greenbelt property are depicted on **Figure 1**.

The City of Santa Cruz developed a master plan for the property to improve natural resource protection and restoration, public access and education. Implementation of the Arana Gulch Master Plan required the City to obtain a coastal development permit (CDP) from the California Coastal Commission because a portion of the planning area lies within the designated Coastal Zone. The CDP (3-11-074) included both standard and special conditions, requiring, among other things, developing the Arana Gulch Habitat Management Plan (HMP) to guide the long-term restoration of the open space. Specifically, Special Condition 3 of CDP 3-11-074 states:

> Arana Gulch Habitat Management Plan. PRIOR TO ISSUANCE OF THE COASTAL DEVELOPMENT PERMIT, the Permittee shall submit for Executive Director review and approval three copies of a final Arana Gulch Habitat Management Plan (HMP). The HMP shall provide for the restoration, enhancement, and long-term management of all Arana Gulch habitat areas (including, as referenced by the Arana Gulch Master Plan, the Coastal Prairie/Tarplant Management Area, the Arana Gulch Riparian and Wetland Management Area, and the Hagemann Gulch Riparian Woodland Management Area) as self-sustaining and functioning habitats in perpetuity. The HMP shall be prepared by a qualified expert in restoration ecology for each of the habitat types, and shall take into account the specific conditions of the site as well as restoration, enhancement, and management goals. The HMP shall be substantially in conformance with the Master Plan documents submitted to the Coastal Commission, including the August 1, 2005 document entitled "A Management Program for Santa Cruz Tarplant (*Holocarpha macradenia*) at Arana Gulch"), including that it can be submitted in a package that includes relevant Master Plan documentation with an addendum that addresses this condition, provided all language is modified to be directive (e.g., "shall" rather than "should") and it complies with the following requirements and includes:
>
> (a) A baseline assessment, including photographs, of the current physical and ecological condition of the restoration and enhancement areas. All existing topography, wet features, and vegetation shall be depicted on a map.

(b) A description of the goals of the plan, including in terms of topography, hydrology, vegetation, sensitive species, and wildlife usage.

(c) A description of planned site area preparation and invasive plant removal.

(d) Any planting either of seeds or container plants shall be made up exclusively of native taxa that are appropriate to the habitat and Arana Gulch region. Seed and/or vegetative propagules shall be obtained from local natural habitats so as to protect the genetic makeup of natural populations. Horticultural varieties shall not be used.

(e) A plan for monitoring and maintenance of habitat areas in perpetuity, including:

- A schedule.
- A description of field activities, including monitoring studies.
- Monitoring study design for each habitat type, including, as appropriate: goals and objectives of the study; field sampling design; study sites, including experimental/revegetation sites and reference sites; field methods, including specific field sampling techniques to be employed (photo monitoring of experimental/re-vegetation sites and reference sites shall be included); data analysis methods; presentation of results; assessment of progress toward meeting success criteria; recommendations; and monitoring study report content and schedule.
- Adaptive management procedures, including provisions to allow for modifications designed to better restore, enhance, manage, and protect habitat areas.
- Provision for submission of reports of monitoring results to the Executive Director for review and approval in perpetuity, beginning the first year after initiation of implementation of the plan. Such Monitoring Reports shall be submitted annually until success criteria are met, and then shall be submitted on an every 3-year basis after that. Each Monitoring Report (annual and 3-year) shall be cumulative and shall summarize all previous results. Each report shall clearly document the condition of the habitat areas, including in narrative (and supporting monitoring data) and with photographs taken from the same fixed points in the same directions as the baseline assessment and prior Monitoring Reports. Each report shall include a performance evaluation section where information and results from the monitoring program are used to evaluate the status of the restoration, enhancement, and long-term management in relation to the interim performance standards and final success criteria. To allow for an adaptive approach, each report shall also include a recommendations section to address changes that may be necessary in light of monitoring results and/or other information, including with respect to current restoration information and data related to the habitat areas in question, and to ensure progress toward and achievement of success criteria. Actions necessary to implement the recommendations shall be implemented within 30 days of Executive Director approval of each Monitoring Report, unless the Executive Director identifies a different time frame for implementation.

(f) Interim success criteria to be achieved in the first year of implementation, tied directly to the annual reporting requirement. Also, measurable goals to achieve habitat improvement over time, subject to modification by the Adaptive Management Working Group.

(g) Implementation procedures, cost estimates, identification and allotment of funding for all HMP activities, and related reporting procedures.

(h) Provisions for minor adjustments to the HMP by the Executive Director if such adjustments: (1) are deemed reasonable and necessary; and (2) do not adversely impact coastal resources.

(i) Identification of the membership of the Adaptive Management Working Group, which initial composition and any future changes shall be subject to Executive Director approval. The Adaptive Management Working Group shall guide all HMP activities under the plan.

(j) All details associated with the grazing program, subject to Adaptive Management Working Group and Executive Director approval, in substantial conformance with the proposed cattle grazing program (see Exhibit P Tab 4).

PRIOR TO COMMENCEMENT OF CONSTRUCTION, the HMP shall be implemented by establishing the Adaptive Management Working Group (AMWG), receiving prioritized first-year management recommendations from the AMWG, and initiating implementation of the highest priority recommendations in the field.

The Permittee shall undertake development in accordance with the approved Arana Gulch Habitat Management Plan.

The HMP guides management of three habitat areas within Arana Gulch: the Hageman Gulch Riparian Woodland Management Area, the Arana Creek Wetland and Riparian Management Area and the Coastal Prairie/Tarplant Management Area. Within the Coastal Prairie/Tarplant Management Area, the HMP focuses on restoration of the coastal prairie and recovery of the Santa Cruz tarplant (SCT); this management area continued to receive the most attention in Year 11 (2024) due to the urgency to revitalize the SCT population. Although the population at Arana Gulch has been perilously low since 2007, with a depleted soil seedbank, recent recovery actions focusing on outplanting of nursery-grown SCT plants has resulted in a significant increase in the SCT population. Since 2021 the number of SCT has increased each year. Each year's plants are a combination of yearly outplantings and natural recruitment from the soil seed bank (seed from previous year plantings). The establishment of SCT from the soil seedbank indicates a level of natural SCT recovery is occurring on site; however, the mechanisms needed for the species long-term recovery are still being studied.

The HMP outlines various management tools for managing the three habitat areas on the site[2]. A key tool described in the HMP is an adaptive management framework for habitat restoration actions. Under this framework, and as required by the CDP, an Adaptive

[2] See Section 3.1, page 33 of Arana Gulch HMP.

Management Working Group (AMWG) was formed to provide scientific expertise on resource management activities to the City and the CCC[3]. In 2024, the AMWG provided input to the City during two meetings on implementation of several components of the HMP.

Implementation of the HMP coincided with the construction of the Arana Gulch Multi-Use Trail project. Bike paths, hiking trails, cattle grazing infrastructure, and bridges were built within the greenbelt. Most of these features were completed in 2014 and the grazing infrastructure was completed in early 2015. The construction activities associated with the multi-use trail project that are relevant to the restoration effort are fully described in the Year 1 (2014) Annual Report (City of Santa Cruz, November 2015).

This is the 11th annual report since adoption of the HMP and while some objectives of the plan have not yet been realized; Year 11 shows a positive trend in SCT recovery as there continues to be success in the SCT outplanting program to increasing the soil seedbank and the successful recruitment of SCT plants from the seedbank. The report is intended to report on the progress of the plan in the monitoring year, provide a comparison to previous year data and trends, and prepare for future management actions. The reader is directed to previous annual reports for specific details and data implemented in these years. The previous annual reports (e.g., Year 1 [2014] Annual Report, Year 2 [2015] Annual Report, Year 3 [2016] Annual Report, Year 4 [2017] , Year 5 [2018] Annual Report), Year 6 (2019), Year 7 [2020], Year 8 [2021], Year 9 [2022], and Year 10 [2023]) are available for review on the City's website (http://www.cityofsantacruz.com/departments/parks-recreation/parks-beaches-and-open-spaces/open-spaces/arana-gulch).

The HMP is grounded in an adaptive management framework. Implementation actions will constantly be reviewed and improved upon. Therefore, this annual report is not intended to lay out every action to be implemented for the upcoming year. It will highlight the actions that have been identified by the City and from AMWG meetings from the monitoring year; however, additional actions may be identified by the City and during AMWG meetings throughout the upcoming year.

[3] See Section 2.2, Page 22 of Arana Gulch HMP.

Figure 1. Location Map

2.2 Report Organization and Purpose

The purpose of this annual report is to describe the current condition of the Arana Gulch habitat areas, evaluate the performance of each area in relation to the interim performance standards outlined in the HMP and included in the CDP, and provide management recommendations for the following year to ensure progress toward and achievement of success criteria. In addition to activities approved under the CDP, this report also reports on activities authorized by a Scientific, Educational, or Management Permit issued by the California Department of Fish and Wildlife (Permit No. 2081 (a)-13-013-RP and Amendment 1, valid to December 31, 2028). This report includes all activities conducted in the calendar year 2024 which is considered to be Year 11 pursuant to actions outlined in the HMP and the CDFW 2081(a) permit.

Additionally, this report describes activities associated with the implementation of Arana Gulch Master Plan improvements where such activities intersect with the goals and objectives of the HMP. The City conferred with technical specialists, including AMWG members, regulatory agency personnel, the City of Santa Cruz Planning and Community Development Department, and members of the public while implementing adaptive habitat management activities on the greenbelt.

The adaptive management framework of the HMP is presented in Section 3. The habitat management actions associated with Master Plan improvements are described in Section 4. Actions implementing the HMP are presented in Sections 5 through 7 under their respective management area. Each management area section includes a summary of the implemented actions as they pertain to the goals and objectives in the HMP, and a performance evaluation. Recommendations for Year 12 (2025) are summarized in Section 8. Please refer to the HMP for technical background information on the Arana Gulch greenbelt and HMP goals and objectives. Please refer to previous annual reports (i.e., Year 1 [2014], Year 2 [2015], Year 3 [2016], Year 4 [2017], Year 5 [2018], Year 6 [2019], Year 7 [2020], Year 8 [2021], Year 9 [2022], and Year 10 [2023]) for specific details on actions implemented in those years.

3. Adaptive Management Framework

3.1 Adaptive Working Group (AMWG)

The City adopted an adaptive management framework for implementation of the HMP. The City facilitated and coordinated habitat management activities with the AMWG in 2024. Two meetings were held with the AMWG in 2024; the minutes from the May 3 and September 11 meetings are presented in **Appendix A**. In addition, the City coordinated and facilitated group email correspondence between AMWG members to solicit input on management activities. The HMP outlines the formation of the AMWG, voting procedures, and other procedures.[4] The list of current members is presented in the meeting minutes **(Appendix A).**

The AMWG provided input to the City on habitat management activities within Arana Gulch throughout 2024. A detailed discussion of AMWG recommendations is included in the sections for each management area and in the meeting minutes. In short, the AMWG provided recommendations on the timing and intensity of seasonal grazing, mowing and other grassland strategies, interest in SCT management actions, and SCT increase and outplanting.

3.2 Public Outreach

In 2024 the City maintained a webpage on the City of Santa Cruz website to communicate restoration efforts to the public and to provide a place for documents related to the requirements of the CDP. The City periodically updated the webpage throughout 2024.

The AMWG meetings (field and virtual meetings) were open to the public and provided a forum for members of the public to express their ideas directly to the members and City. Public comments were also generated through the City's website and the AMWG was briefed of public comments and concerns during AMWG meetings.

Signage was maintained onsite with a web address for notifying the City on any concerns regarding grazing or other public access issues within the greenbelt. The City also coordinated with UCSC, the Santa Cruz Natural History Museum, the Coastal Watershed Council, the California Native Plant Society, and other volunteers for the SCT outplantings that occurred in February 2024 and with the Earth Stewards program for invasive plant management.

3.3 Evaluation of Adaptive Management HMP Goals

A goal of the HMP is to maintain an adaptive management framework to allow stakeholders to conduct and evaluate actions. To meet this goal there are two objectives: conduct an annual

[4] See pages 22-24 of Arana Gulch HMP

AMWG meeting and maintain funding levels. In 2024, two meetings were held with the AMWG (May and September) and there was email correspondence with AMWG members to present information and solicit feedback. The City dedicated funding to implement the habitat management actions identified in the HMP based on a prioritization recommended by the AMWG. The City and the AMWG re-visited HMP management actions at the September 2024 meeting, particularly the HMP objectives for each management area. The AMWG also provided input to the City during the review of the 2024 SCT outplantings, the fall season management actions, and plans for SCT outplantings in 2025.

To meet Objective 1B, the City dedicated Arana Gulch management as a line item in the City Parks and Recreation Departments operating budget. The City also hired a maintenance person that is partially dedicated to the Arana Gulch greenbelt. The position was filled in January 2016.

A second adaptive management goal is to conduct a two-tracked program of management and research with monitoring. The management actions implemented in 2024, such as seasonal grazing, seasonal mowing in Area A South, and perimeter seasonal mowing, were monitored to determine their effectiveness in meeting biological variables. The HMP identified a timescale for implementation of the management actions relative to the SCT with an objective of increasing the number of aboveground SCT to at least the 2006 level (348 plants) by 2016 (first year after grazing). Plant propagation occurred at UCSC Greenhouses and with the experimental outplanting of over 1,000 SCT plants onto the site in 2024 (in addition to outplantings in 2021, 2022, and 2023), the project met this target in 2024 with plant recruitment in Area A from the soil seedbank (from previous year outplantings) as well as the 2024 outplantings in Area A and Area C.

The timescale presented in the HMP for restoration of the coastal prairie or invasive plant control is to progress to a more functioning system by 2020. In 2024, the City continued to implement a mowing program in the southern portion of Area A for SCT as well as for coastal prairie enhancement. Monitoring of plant cover and species diversity in 2024 provides additional information on the effectiveness of these actions for prairie enhancement.

The third adaptive management goal is to develop educational opportunities within Arana Gulch, with efforts to conserve and restore its rare resources. Students and staff volunteers from UCSC as well as public volunteers participated in the SCT outplantings; some students received volunteer class credit. Volunteers from the Watershed Stewardship Program and Earth Stewards Project also participated in on-site habitat management. The City maintained a web page on the City's website to post information about the HMP and received input from the AMWG and the public consistent with Objective 3A. Additional recommendations for public outreach were identified by the AMWG and the public (i.e., signs for cattle grazing and developing a brochure on cattle grazing) and the City implemented them. **Table 1** presents a summary of the objectives for adaptive management, actions implemented in 2024, and whether the actions were in compliance with the HMP.

Table 1. Monitoring of Adaptive Management Variables

Objective and Variable	Actions in Year 11	Year 11 Results	Objective Met?
Goal 1. Maintain an adaptive management framework that allows stakeholders to scientifically conduct and evaluate actions			
Objective 1A. Conduct at least 3 AMWG meetings in 2013 with a quorum of members present each time. In subsequent years, the frequency of meetings beyond an annual November meeting can be determined by the needs of the AMWG.	Meetings held May 3 and September 11	Meeting minutes presented in Appendix A	Yes, two meetings in 2024. Email correspondence was conducted with AMWG members periodically in 2024
Objective 1B. Maintain funding levels to achieve a level of habitat management that is 1) indefinitely sustainable into the future, and 2) shows a stable or increasing trend in measured biological variables over a biologically appropriate timescale.	Funding allocated by City; line item established in operating budget	Funding allocated by City for fiscal year July 1, 2023 to June 30, 2024 and July 1, 2024 to June 30, 2025	Yes, the budget funds staff, consultant, and contractor time to improve management, implement projects, conduct studies, and /or implement improvement, resulting in an increase in the measured biological variables
Goal 2. Conduct a two-tracked program of management and research with built-in monitoring			
Objective 2A. Maintain a Management Track that leads to stable or increasing trend in measured biological variables over a biologically appropriate timescale.	The City incorporated AMWG recommendations into multiple management actions including a second year of outplanting, mowing, and grazing.	Data from studies and monitoring were considered by City and AMWG during management decisions	Yes, monitoring of biological variables and trends were conducted as outlined in the HMP. The AMWG recommended continued outplanting of SCT to develop a robust soil seedbank. AMWG recommended multiple management actions (mowing, grazing) to aid in SCT seed dispersal and create suitable conditions for SCT germination.
Objective 2B. Utilize a Key Management Question (KMQ) framework to guide the Research Track when research is needed to achieve the specific goals and objectives for SCT and the coastal prairie.	An SCT outplanting plan was implemented in 2024 to add SCT seed into the system. A fall season management program was developed to examine SCT seed dispersal and	Recruitment of SCT in F_1 – F3 generations and 90% survival of 2024 SCT outplantings. Total population of SCT of approx. 4,141 plants in two areas.	Yes, the SCT Outplanting Plan developed in 2021/22 was successful and was repeated in 2024. The fall season management actions will be evaluated as to whether the actions continue to provide SCT population recovery.

Table 1. Monitoring of Adaptive Management Variables

Objective and Variable	Actions in Year 11	Year 11 Results	Objective Met?
	management of SCT-occupied areas.		
Goal 3. Develop public educational opportunities associated with Arana Gulch and efforts to conserve and restore its rare resources			
Objective 3A. Maintain a website to communicate restoration efforts to the public and provide a place for documents related to the requirements of the CDP, such as Monitoring Reports.	Webpage on City website developed in 2013	Webpage updated in 2024 with new information	Yes, City periodically updated website with reports and information as needed

4. Implementation of Master Plan Improvements

Construction of the Arana Gulch Multi-Use Trail was initiated in fall 2013 and was completed in December 2014. This east-west trail extends from Brommer Street (east of the greenbelt) westward to Broadway Street (west side of greenbelt, across Hagemann Gulch). The Agnes Street Trail extends southward from Agnes Street to join the east-west multi-use trail midway within the greenbelt. This trail was also constructed in 2014. Cattle infrastructure was installed in 2014 including fences, access gates, water line/water troughs and a temporary holding corral near Agnes Street. The Marsh Vista Trail, a pedestrian trail located along the east side of Arana Creek, was constructed in 2013. In 2018, improvements were made to a portion of the Coastal Loop Trail. The location of this trail and other master plan improvements is presented in **Figure 2**. Figure 2 also includes the location of the historic SCT areas called A-D.

4.1 Multi-Use Trail and Infrastructure Management

4.1.1. Current Management

In collaboration with a volunteer trail-building organization, the City conducted repairs to an eroded section of the Coastal Prairie Loop Trail in 2023. In response to public concern about user impacts to Area B, split-rail fencing was installed in 2021 near the Hagemann Gulch bridge to reduce off-trail use. Hydromulch and hydroseeding have been utilized in various areas for erosion control related to use along the edge of paved trails and also along user-created trails.

Cattle grazing signs, installed at each entrance and along the fence, were maintained throughout the year. The signs continue to provide contact information to the City and rules of the site. The water troughs were maintained throughout the grazing season. Some vegetation recolonized the site of the former water trough site in Area A (trough was moved southward approximately 100 feet in 2016).

A cross-fence was installed in Area A in 2023, creating Area A North and Area A South pastures. The Area A South pasture was further divided into two areas in January 2024, creating two new pastures: Area A Southwest and Area A Southeast. The location of these cross-fences is shown on **Figure 2.**

In 2024, the City built a new split rail fence along a portion of the Marsh Vista Trail to deter campers from inhabiting the riparian wetlands. The harbor entrance/exit trail area was rehabilitated with improvements to the decomposed granite pathway, drainage and a new retaining wall. This work was done to prevent water from flowing into the harbor storage area and divert it onto the path.

4.1.2. Past Management

Project conditions of approval required the salvage of topsoil from areas within 20-feet of mapped tarplant if such areas were disturbed during trail construction. In December 2013, the upper 6 inches of topsoil from an area upslope of Tarplant Area D was salvaged and spread onto an approximately 3,750 square foot area south of Tarplant Area C. No SCT plants have been observed within the receiver site.

The Agnes Street Trail Connector construction disturbed a section of soil within 20 feet of Tarplant Area C in September 2014. On September 15, 2014, the upper 6 inches of topsoil from this area of approximately 2,900 square feet was salvaged and spread onto areas Southwest and northwest of Tarplant Area C. No SCT plants have been observed within the receiver site. The temporary construction access road used during trail construction in 2013 and 2014 was allowed to naturally revegetate from the existing soil seed bank.

Poor drainage along the edge of the central east-west trail was observed in winter 2016. An AMWG member expressed concern that water was not passing under the trail, as designed, and water was prevented from reaching the downslope prairie. In 2016, City staff installed a series of small gravel drains to enable water to penetrate the engineered drainage system under the pathway. Staff believed that the clay content of the top soil was not allowing effective penetration to the drainage rocks beneath it. City staff have continued to monitored these areas.

4.2 Photo Point Monitoring

Photo points for long-term monitoring were established in April 2015. These photo points are to be re-taken each year. The photo points (15) are distributed throughout the coastal prairie with two additional points on the Arana Creek Causeway and two on Hagemann Bridge (**Figure 3**). All points are located at either an interpretative sign or a fence corner for easy reference. Four photos are taken per point in a clockwise order facing into the enclosure; Photo 1 looks straight ahead, Photo 2 is to the right, Photo 3 looks straight behind, and Photo 4 to the left. All photos can be taken in about one hour, preferably when the sun is high in the sky and casting few shadows. The two points taken on the causeway looking into Arana Creek give a general idea of conditions in the riparian area. The additional points located on Hagemann Gulch Bridge look out and down into the Gulch. One extra point is taken standing in front of the entry sign at Frederick Street in order to observe the recovery from the construction. The photo -monitoring was conducted in April 2024; these photos are presented in **Appendix B.**

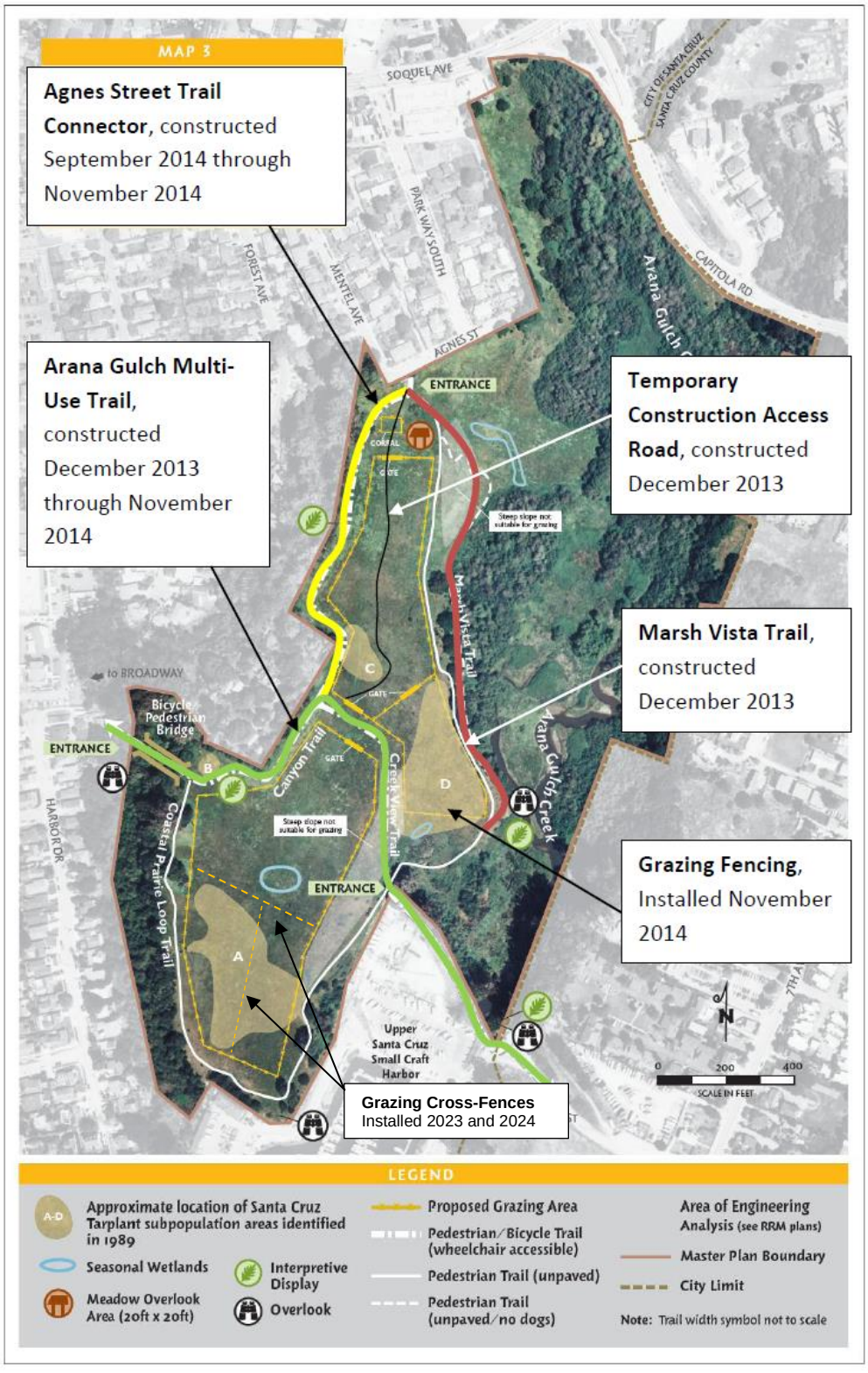


Figure 2. Master Plan Improvements, 2013 - 2024

Figure 3. Location of Photo Points for Long-Term Monitoring

5. Coastal Prairie/Santa Cruz Tarplant Management Area

The coastal prairie occupies approximately 30 of the 67 acres at Arana Gulch and is essential because it has supported the third largest standing native Santa Cruz tarplant (SCT) population and is one of only 13 populations found in Santa Cruz County (USFWS, 2015). A primary focus for this management area is the recovery of the SCT, because the population at Arana Gulch has declined over the last two decades[5]. This section describes management and monitoring actions for the SCT (Section 5.1), coastal prairie grassland (Section 5.2), grazing and stocking work program (Section 5.3), and the invasive weed work plan (Section 5.4). Section 5.5 includes an evaluation of progress toward meeting the goals and objectives outlined in Section 3.0 of the HMP. Section 5.6 provides proposed actions for 2025.

Activities implemented within this management area in 2024 include: cattle grazing, perimeter mowing, seasonal mowing in the southern portion of Area A, outplanting of container-grown SCT, and invasive weed control. Monitoring of these and previous year actions occurred throughout the year. City staff, City consultants, and volunteers from UCSC, the public, Santa Cruz Natural History Museum Earth Stewards Project, and the Watershed Stewardship Program implemented these tasks. In addition, the City and UCSC Greenhouses coordinated on SCT seed storage and plant propagation.

5.1 Santa Cruz Tarplant

The recovery actions for SCT implemented in 2024, including an annual census (5.1.1), outplanting (5.1.2), and management actions to aid in seed dispersal and species recovery (5.1.3), are described in the following sections.

5.1.1 Santa Cruz Tarplant Census

The HMP requires an annual census of the population (Goal 1) and a baseline assessment of SCT within the soil seed bank (Goal 4). Field surveys for SCT at Arana Gulch were first conducted in 1977 by botanist Randy Morgan but plant counts are lacking in the current database. In 1986, he estimated there were more than 100,000 plants on the property. In 1989, R. Doug Stone identified SCT in four locations he called Areas A-D (see **Figure 1 and 2**). These area designations have remained in use.

The census for SCT was conducted by Kathleen Lyons following guidelines from *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities* (CDFW), *CNPS Botanical Survey Guidelines* (CNPS, 2001), and *Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed and Candidate Species* (UFWS (2011). Field surveys to determine the presence/absence of SCT

[5] See Section 3.1, page 63 of Arana Gulch HMP.

were conducted in May, June, August and September 2024. This survey period coincided with the growth and blooming period of SCT. Surveys were conducted by walking the grassland over multiple days to detect SCT. Survey days were May 13, June 26, August 7, and September 11. As per protocol, if a SCT was observed a waypoint would be taken with a handheld Global Positioning System (Gaia software) that would record the plant's patch location. If found, the protocol includes recording patch size, plant height, branching, flowering status, and estimating the number of flowering heads per plant. The 2024 survey was conducted in an above-average rainfall year.

Within Area A Southwest, 569 SCT plants were found in five patches. This is an increase from 2023. The plants were found in areas subject to previous year SCT outplanting. Almost all of the natural recruits were located within Area A. Most were found within the previous year(s) outplanting plots and likely grew from SCT seed naturally broadcast by the survivors of these outplantings, representing a F_1 generation. Most plants recruited into previous woodchip mulched plots. There was just one SCT observed outside of the 2023 plots and could be an F_2 or F_3 generation. Most of the plants were small, single stem plants with only 3-8 flowerheads each. One plot supported well-developed and branched plants, averaging 15 inches in height and 14 flowerheads per plant. Total flowerhead production was estimated at 3,644.

Within Area A Southeast, approximately 3,134 SCT plants were found in six patches. This is an increase from 2023. The plants were found in areas subject to 2023 SCT outplantings and grew from SCT seed naturally broadcast by the survivors of these outplantings, representing a F_1 generation. The plants recruited into previous woodchip mulched plots. Most of the plants were small, single stem plants with 4 flowerheads each. One plot supported well-developed and branched plants, averaging 13 inches in height and 20 flowerheads per plant. Total flowerhead production was estimated at 15,300.

There were 705 surviving SCT outplantings in Area A Southeast (90% survival rate) and 302 outplantings alive in Area C (90% survival rate). The 2024 SCT outplantings in both Area A Southeast and Area C were multi-branched, averaging 15 inches in height and supported 30 flowerheads per plant. For 2024, the SCT plants produced an estimated 49,154 flowerheads. Approximately 40,094 were produced in Area A and approximately 9,060 were produced in Area C. In Area C, no SCT plants recruited from the 2023 outplantings.

Total number of SCT on site in 2024 was 4,141; a summary is presented in **Table 2**. The distribution of the species on the site is presented on **Figures 4, 5, and 6**. **Figures 7-10** show several SCT occurrences.

Table 2. Summary of 2024 SCT Census

Area	Number of SCT	Patch Size	Previous Outplanting Site?	Average Height	Average Number of Flowerheads per Plant	Approx. Number of Flowerheads
Area A, Southwest Pasture						
1	79	10’ x 10’	Yes, 2023	8”	8	632
2	125	10’ x 10’	Yes, 2021 or 22	15”	14	1,750
3	34	10’ x 10’	Yes, 2023	8”	8	272
4	330	10’ x 10’	Yes, 2023	8”	3	990
4A	1	1x1	Unknown	8”	5	5
Subtotal	**569**					3,649
Area A, Southeast Pasture						
5	500	10’ x 10’	Yes, 2023	10”	8	4,000
6	190	10’ x 10’	Yes, 2023	13”	20	3,800
7	450	10’ x 10’	Yes, 2023	7”	4	1,800
8	300	10’ x 10’	Yes, 2023	7”	4	1,200
9	625	10’ x 10’	Yes, 2023	7”	4	2,500
10	500	10’ x 10’	Yes, 2023	7”	4	2,000
Subtotal	**2,565**					15,300
Area A TOTAL	**3,134**					
February 2024 Outplantings						
Area	Number of SCT	Number of Plots	Number of SCT Installed	Average Height	Average Number of Flowerheads per Plant	Approx. Number of Flowerheads
Area A SE	705	10 plots	784	15”	30	21,150
Area C	302	4 plots 2 flats	334	15”	30	9,060
Outplant TOTAL	**1,007**		**1,118**			30,210
SCT TOTAL	**4,141**					

Figure 4. Distribution of SCT, 2024

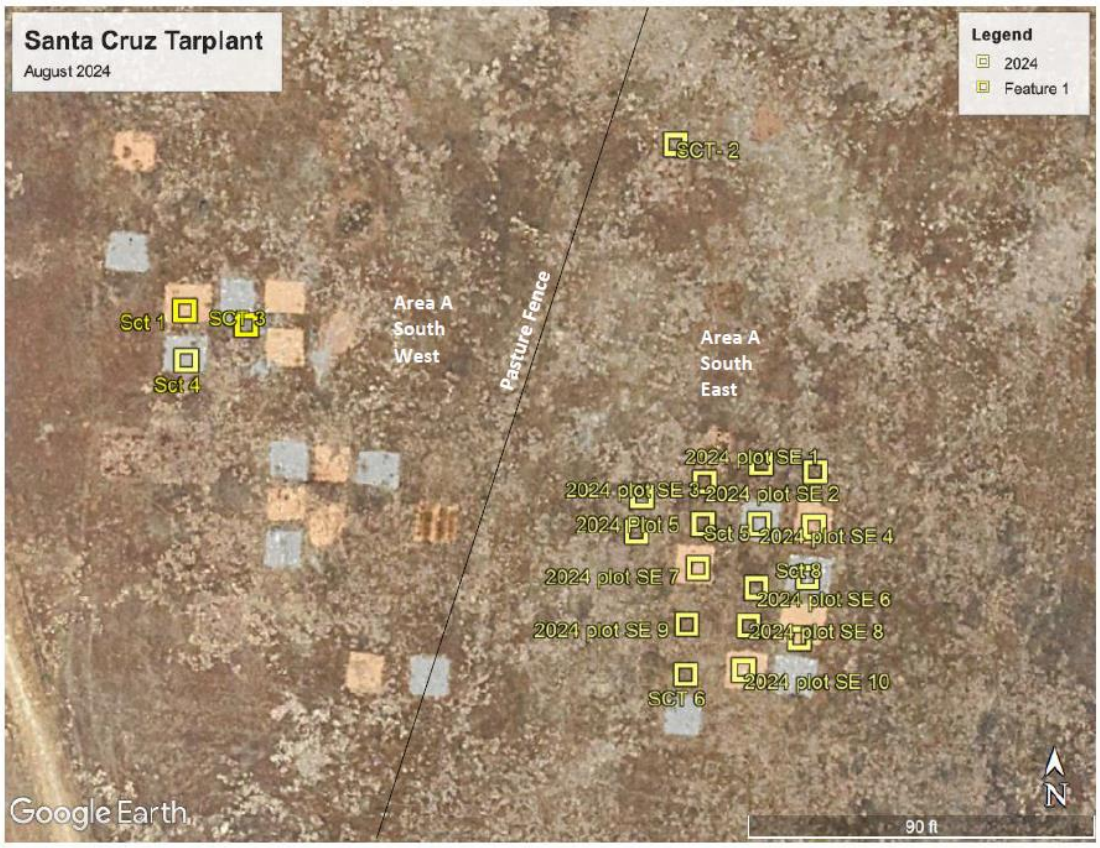


Figure 5. Distribution of SCT in Area A, 2024

Figure 6. Distribution of SCT in Area C, 2024

Figure 7. SCT Occurrence #7; 450 SCT Plants in Area A SE, Previous Year Outplanting Plot

Figure 8. SCT Occurrence #4; 330 SCT Plants in Area A SW, Previous Woodchip Plot

Figure 9. SCT Occurrence #2; 125 SCT Plants in Area A SW, Previous Woodchip Plot

Figure 10. 2024 SCT Outplanting Plot, Area A SE

UCSC collected SCT seed in 2024. As per conditions of the City's 2081 permit with CDFW, SCT can be collected if there are more than 50 plants. The permit is valid until December 2028.

5.1.2 SCT Outplanting

Background. Due to a highly depleted SCT seed bank and the failure of SCT recovery through site disturbance (e.g., mowing, grazing), an alternative SCT Habitat Enhancement Work Plan was developed in 2019, and amended in 2020. The work plan recommended changing site management from disturbance strategies designed to stimulate the seedbank (such as just grazing or scraping) to planting container-grown SCT as a means to increase the SCT seed bank for species recovery. Planting treatments were identified that represent a gradient of management intensity. The treatments are listed below; the outplantings (treatments 3 and 4, below) did not receive supplemental irrigation:

1) no treatment control ("grazing release" treatment in Area A and C),
2) mowing one time (simulated with string trim; Area A),
3) sheetmulch treatment (Area A), and
4) no treatment, with grazing (Area D).

Outplanting of nursery-grown SCT plants was initiated in 2020, wherein UCSC Greenhouses successfully propagated 28 SCT plugs from site-collected seed. These plants were installed into a pilot planting plot in Area C. The pilot outplanting resulted in 6 plants surviving to flower. Following the success of this first outplanting, subsequent plant propagation and outplantings were conducted in 2021, 2022, and 2023.

Grazing was suspended in Area A to evaluate the treatments independent of grazing impacts, and therefore the 2021 control treatment was considered a "grazing release" treatment. Treatment 3 consisted of sheet mulching the planted plots, using overlapping sections of single ply B-flute cardboard (flat on one side and corrugated on the other) followed by a layer of wood chips or straw mulch to a depth of 2-3 inches. Sheet mulching was used to suppress weed germination, enhance soil moisture retention, and increase organic matter accumulation.

Outplantings of nursery-grown SCT continued in 2021, 2022, 2023, and 2024. Please refer to previous year annual reports as to the specific outplantings actions/techniques used in 2021-2023; a summary of these outplantings is presented herein.

Summary of 2021 Outplanting. SCT outplanting were installed in Area A (994 plants), C (69 plants), and D (69 plants) in January and February 2021, using various sheetmulch techniques. Plantings were also installed in control plots.

Plant survival of outplantings was 52% in Area A, wherein approximately 52,000 flowerheads were produced. Plant survival in Area C was 48%, with approximately 192

flowerheads produced. Plant survival was 0% in Area D; no plants survived to produce flowerheads/seed.

Natural first-year recruitment of SCT from the 2021 plots was evaluated in summer 2022. Recruitment within the 2021 plots was extremely variable and was limited to the plots in Area A. There was virtually no recruitment in the control/mow plots. Recruitment only occurred within the sheetmulch plots. In June 2022, a "lawn" of thousands of emerging seedlings was observed in a single subplot; however, only 5 SCT emerged and flowered in another subplot. Several other subplots supported SCT; the average number of SCT plants in these subplots was 90 (plants per plot). By the time of the final assessment in late September 2022, the number of flowering SCT was still as variable and ranged from only 3 to an estimated 500 plants in 2 different sub-plots. Raking the woodchip in the fall appeared to improve recruitment. In un-raked subplots, an estimated 200 SCT recruited and flowered, producing around 900 flowerheads. Approximately 700 SCT recruited and flowered in plots raked in mid-October and 600 in plots raked in early November, producing an estimated 1,500 and 2,000 flowerheads, respectively. Overall an estimated 1,500 SCT recruited and produced 4,500 flowerheads.

Figure 11. Location of 2021 Experimental SCT Planting Plots in Area A (Orange), C (Blue), and D (Red).

Summary of 2022 Outplanting. In March 2021, the City received funding from the Ventura Fish and Wildlife Office Recovery Project to continue implementation of the Habitat Enhancement Plan with three main elements: additional greenhouse propagation of SCT plants at the UCSC Greenhouses, implementation of a second phase of outplanting in 2022, and laboratory research on SCT germination cues at UCSC. The primary goal of the

additional round of planting in 2022 was to establish container-grown SCT plants to increase seed production and provide further protection against the possible extirpation of the population at Arana Gulch. An experimental design was developed to test additional planting strategies to determine which methods lead to the greatest *in situ* survival and reproduction, measured as mature SCT flower head production per plant. UCSC Greenhouses propagated approximately 1,400 SCT for use at Arana Gulch. Planting locations in Area A are shown on **Figure 12.**

Figure 12. Locations of 2021 and 2022 SCT Macroplots in Area A

Survival of the 2022 planting cohort was much lower than expected. The cardboard-only treatment was discontinued almost immediately when the plots were destroyed by wind. The straw mulch treatment was only marginally more successful, with less than 10% of planted SCT surviving to flower. Average survival in other treatments was only 20% to 30%. The low survival is likely due to persistent drought conditions. Total precipitation from the beginning of January through May was only 3.7-inches, and no rainfall greater than a tenth of an inch fell from January 5th to March 27th. In addition to drought, extensive gopher herbivory

was observed along with strong competitive pressure by weeds. The straw mulch appeared to be very prone to gopher damage and less effective at suppressing weeds.
Plant survival of outplantings in Area A was 18%, wherein approximately 15,000 flowerheads were produced. Plant survival in Area C was 34%, with approximately 700 flowerheads produced.

Summary of 2023 Outplanting. In February 2023, the City implemented another year of SCT outplantings with the continued goal of establishing container-grown SCT plants on site that would survive and produce seed, thus increasing the soil seed bank to aid in species recovery of increasing on-site seed production. UCSC Greenhouses propagated approximately 1,091 SCT. Planting locations in Area A are shown on **Figure 13.** In February 2023, 997 plants were installed within the southern part of Area A (Area A south) and 94 plants were installed in Area C (cattle exclosure).

Area A South. 24 plots were planted with 997 SCT in February 2023 in 3 macroplots (122, 222, and 322) that were established in 2022. The plots were previously planted in 2022; yet there was no SCT survival in these plots; therefore, these vacant plots were re-planted in 2023. The plots were bare or were sheet-mulched with either straw or woodchip.

Area C. Four plots were planted with 94 SCT in February 2023. The plantings occurred within two plots that were previously planted in 2022 where there was no SCT survival, as well as two new plots. The plots were sheet-mulched with either straw or woodchip. One plot (D) was planted along the edge of the cattle exclosure, abutting the pasture.

Plant survival of outplantings in Area A was 88%, wherein 877 plants were on site; approximately 34,980 flowerheads were produced. Plant survival in Area C was 81%, with 76 plants and approximately 3,040 flowerheads produced. An above-average rainfall likely contributed to the high plant survival rates.

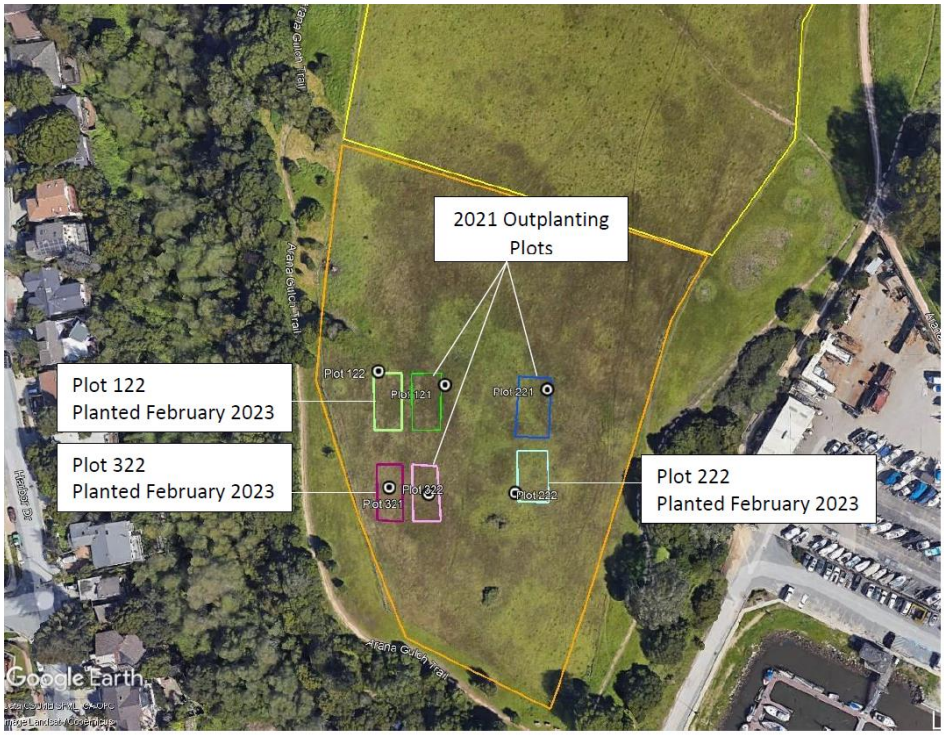


Figure 13. Locations of 2023 SCT Macroplots in Area A

Figure 14. Locations of 2023 SCT Macroplots in Area C

5.1.2.1 SCT Outplantings in 2024

The goal of the 2024 SCT outplanting was to continue to establish container-grown SCT plants on site that would survive and produce seed, thus increasing the soil seed bank to aid in species recovery. UCSC Greenhouses propagated 1,118 SCT plants in "stubby tubes" to be used in the outplanting. In February 2024, 784 plants were installed within the Southeast portion of Area and 334 plants were installed in Area C (cattle exclosure).

Area A Southeast. Ten plots were planted with 748 SCT in February 2024. The plots were located in close proximity to the 2023 plots. The plots were bare (weed-whipped) prior to plantings and after installation of the SCT plugs, the plots were sheet-mulched with woodchips. Planting locations in Area A Southeast are shown on **Figure 15.**

Area C. Four plots were planted with 334 SCT in February 2024. The plots were sheet-mulched with small-sized woodchip; one plot also had cardboard under the wood chip. Two small flats of SCT seedlings were also installed. Planting locations in Area C are shown on **Figure 16.**

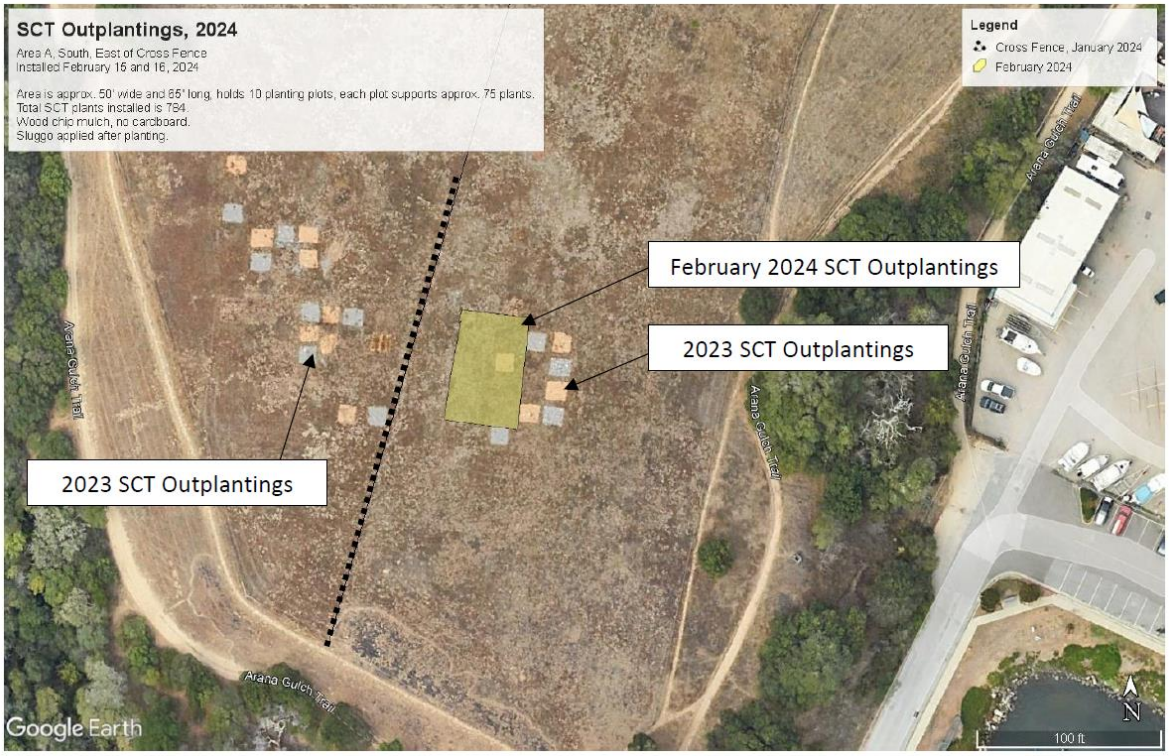


Figure 15. Locations of 2024 SCT Plots in Area C

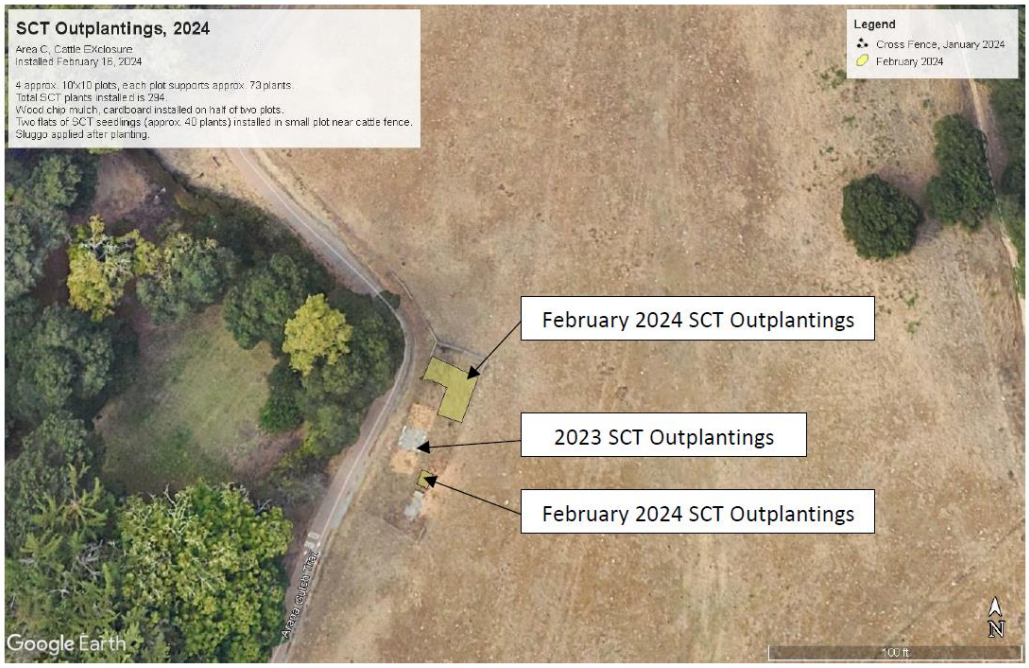


Figure 16. Locations of 2024 SCT Plots in Area C

2024 Outplanting Results

Precipitation. The 2023/24 water year was above average. This occurred after one previous year of above-average rainfall (2022/23) yet after 4 previous years of below average rainfall. Rainfall was 34.82 inches for the water year (October 1, 2023 to September 30, 2024). Most rainfall occurred December through marsh; January had the highest amount of rainfall (**Figure 17**).

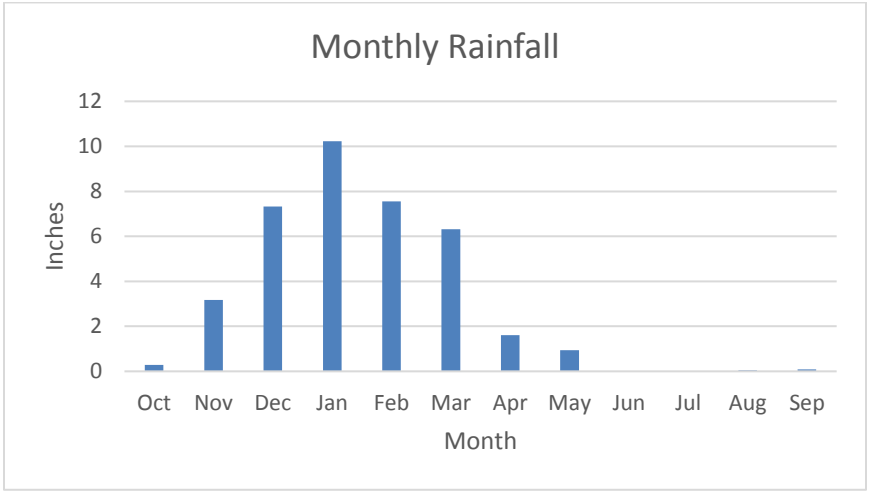


Figure 17. Monthly Rainfall from DeLaveaga Weather Site, 2023/24 Water Year

Maintenance. The outplanting plots were not irrigated in 2024. In April, hand weeding was conducted at each plot, primarily removing English plantain, cat's ear, and filaree from around the installed SCT plants. In April, May and July, the perimeter of the 2024 plots were mowed to control non-native grass growth (mostly *Avena)* (**Figure 18**). No other maintenance was implemented in the plots in 2024.

Figure 18. Mowing within Area A and Around Perimeter of Outplanted Plots, April 2024

Monitoring. The plots were monitored for plant survival and flowerhead production in August and September. Within the Area A Southeast outplanting plots, the survey found 705 SCT plants within the plots, yielding a 90% survival rate. Plants were robust, with a fairly uniform height of 15 inches. The number of flower heads per plant is high; a sampling of plants found an average of 30 flowerheads per plant. The yield of flowerheads from the plants is approximately 21,000.

Within Area C, the survey found 302 SCT plants within the plots, yielding an 90% survival rate. Plants were robust, with a fairly uniform height of 15 inches. The number of flower heads per plant is high; a sampling of plants found an average of 30 flowerheads per plant. The approximate yield of flowerheads from the plants is approximately 9,000.

The status of the Area A Southeast outplantings between February and August are shown in **Figures 19 and 20**. The Area C outplantings are shown in **Figure 21** and spot photos of the SCT in outplanting plots are shown in **Figures 22 and 23**.

Photos, Area A Southeast

Figure 19. View of Plots 1, 2, and 3, February 2024 and SCT in Plots in August 2024

Figure 20. View of Plots 6 and 7, February 2024 and SCT in Plots 7 in August 2024

Photo Points, Area C

Figure 21. View of Area C Plots 3, 2, and 1 and SCT in Plots in August 2024

Figure 22. SCT in Area A Plot, August 2024

Figure 23. Location of 2024 Plots and SCT Outside of Plots

5.1.3 SCT Research

No research studies were conducted on SCT in 2024. The results of a 2022 study on seed germination was completed in March 2023 and was presented in the Year 9 (2022) Annual Report: *Germination Study: Dormancy in Ray Achenes of Holocarpha macradenia, a Rare Coastal Prairie Forb* (Childress, 2023).

USFWS prepared a Species Status Assessment (SSA) for SCT in 2023. A synopsis of the SSA was presented in the Year 10 (2023) Annual Report. The SSA founds that actions to reduce competing biomass is key once a site has a suitable size seedbank. The SSA study suggests a large seedbank is needed to maintain a population, but what constitutes "large" is not known. This study is expected to inform future actions at Arana Gulch, as the AMWG determined the SCT seedbank is still in "recovery" mode (developing a suitable seedbank and identifying suitable management) and the population is not yet in a "maintenance" mode.

5.2 Grassland/Coastal Prairie

5.2.1 Grazing and Mowing

Management actions for the SCT consisted of seasonal grazing of the historic SCT colonies in the northern portion of Area A and Areas C and D (and surrounding grassland), seasonal mowing in the southern portion of Area A, and seasonal weed-whipping of Area B. Grazing was initiated in Area A (north and then to Southwest) on January 1 and cows/calves were in this pasture until March 15, when they were moved to Areas C and D. Animals were moved to and from Areas A, C, and D periodically throughout the rest of the year. Further details on the grazing program can be found in Section 5.3.

Mowing Within Area A South. Area A Southwest and Southeast were mowed in April, May, and July with a rotary mower (Toro deck mower) set at six inches. The 2024 SCT outplanting plots in the Southeast, as well as stands of purple needlegrass, were excluded from mowing. The purpose of the mowing was to reduce cover by non-native plants to benefit native plant species, including SCT.

Mowing Outside Grazing Fences. Outside of the grazing fences, grassland mowing occurred within areas delineated to remain as grassland (from the fence to the drip line of the adjacent woodland), as depicted in **Figure 24**. Perimeter fuel break mowing was also identified along the trails; this mowing occurred in May. At the time of the May mowing, grass height averaged three feet. Areas subject to mowing are depicted on **Figure 25**. The City weed whipped Area B once in mid-June.

Using previous year recommendations from the AMWG, mowing of non-grazed areas (except for southern portion of Area A) occurred once a year in June, after a botanist inspects the site to assure that native plants, such as Mariposa lilies, would not be adversely affected.

Prior to the May mowing, the City authorized a botanical review and a breeding bird survey of the mowing areas to ascertain if native plant species or nesting birds would be directly affected by the mowing. Kathleen Lyons, plant ecologist, conducted the botanical review and Garvin Hoefler, wildlife biologist, conducted the breeding bird survey. No breeding birds were detected in the areas subject to mowing; however, several colonies of locally unique plants along the Prairie Loop Trail were flagged such that mowing would avoid these areas.

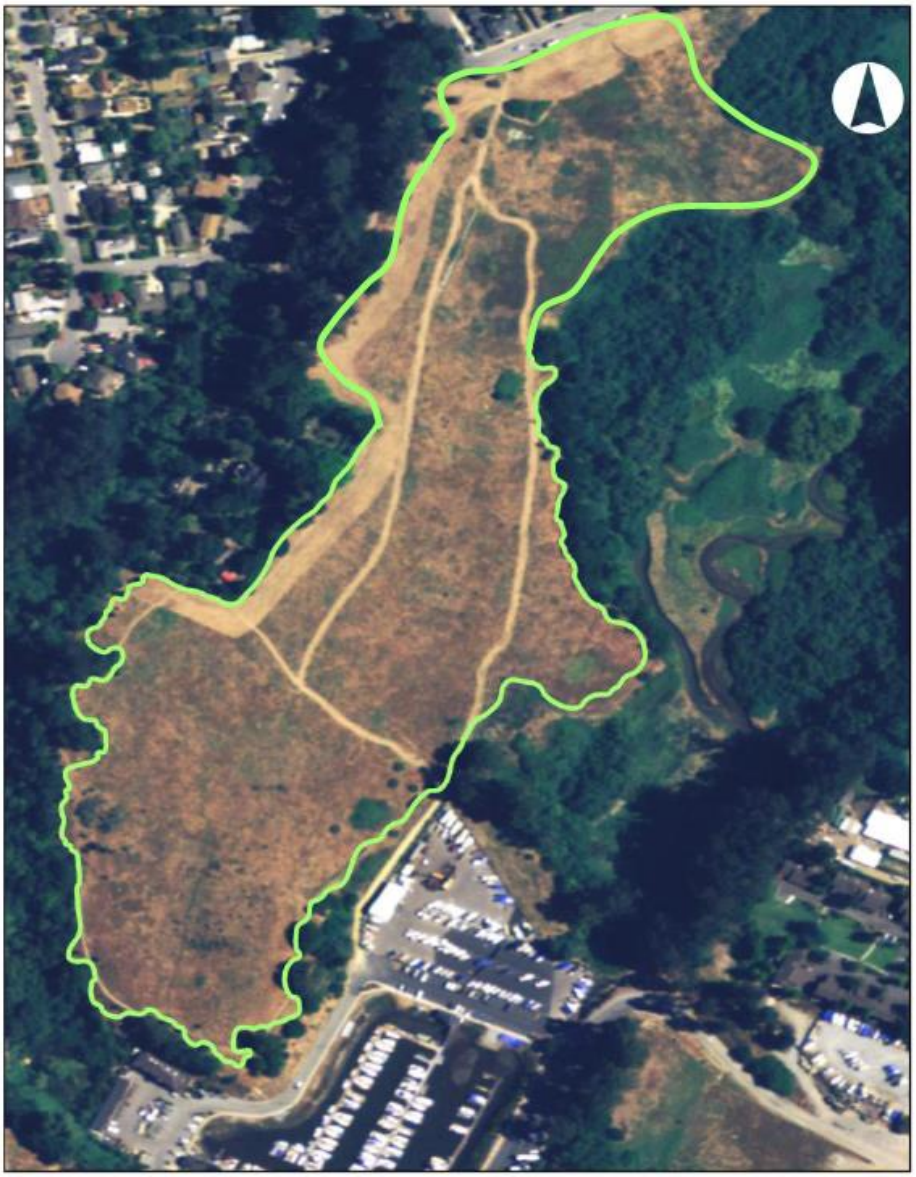


Figure 24. Delineated Grassland, April 2015

Figure 25. Areas Mowed in 2024

Fall Season SCT Management. In fall 2024, with input from the AMWG, fall season management actions were developed for the grassland areas supporting SCT plants. The actions were developed by the AMWG at the November meeting and the following actions were identified:

1. Area A, Southwest: After approximately one-inch of rainfall, allow cattle to access this area to stomp ground, increase seed/soil contact, and eat thatch and young grass growth. Consider installing mineral block or molasses barrel to encourage cows to be within SCT-occupied area, as needed. Monitor SCT seedling recruitment and remove cattle if significant browse/damage to SCT seedlings is observed.
2. Area A, Southwest: Spread some on-site SCT seed heads/plants onto cattle trampled areas to facilitate spread of the species.
3. Area A, Southeast: No action.
4. Area C SCT Plot. Allow cattle to access this area to stomp ground, increase seed/soil contact, and eat thatch and young grass growth. Monitor SCT seedling recruitment and remove cattle if significant browse/damage to SCT seedlings is observed.

5.2.2. Outplanting of Native Grasses

No new grass plugs were installed on site in 2024; however, the status of the 2023 plantings was monitored. In February 2023 grass plugs (5 species) were installed in Area A South for grassland/prairie enhancement (see **Figure 26**). None of the plantings were irrigated and all were subject to spring/summer mowing. **Table 3** displays the species and number of plants installed and the Year 2 survival rates observed in 2024.

Table 3. Year 2 Grass Plug Survival, Area A South

Area	GPS	Species	# Installed	# Alive 7/24	% Survival
Plot 122	36.97425 -122.00074	*Danthonia californica*	98	60	61%
E side	36.97425 -122.99990	*Elymus glaucus*	72	47	65%
E side	36.97421 -122.00001	*Bromus carinatus*	66	34	51%
Wet plot	36.97465 -122.00061	*Deschampsia ceaspitosa*	70	60	86%
Wet plot	36.97459 -122.00047	*Hordeum brachyantherum*	94	Not found	0%
TOTAL			**400**	**201**	**50%**

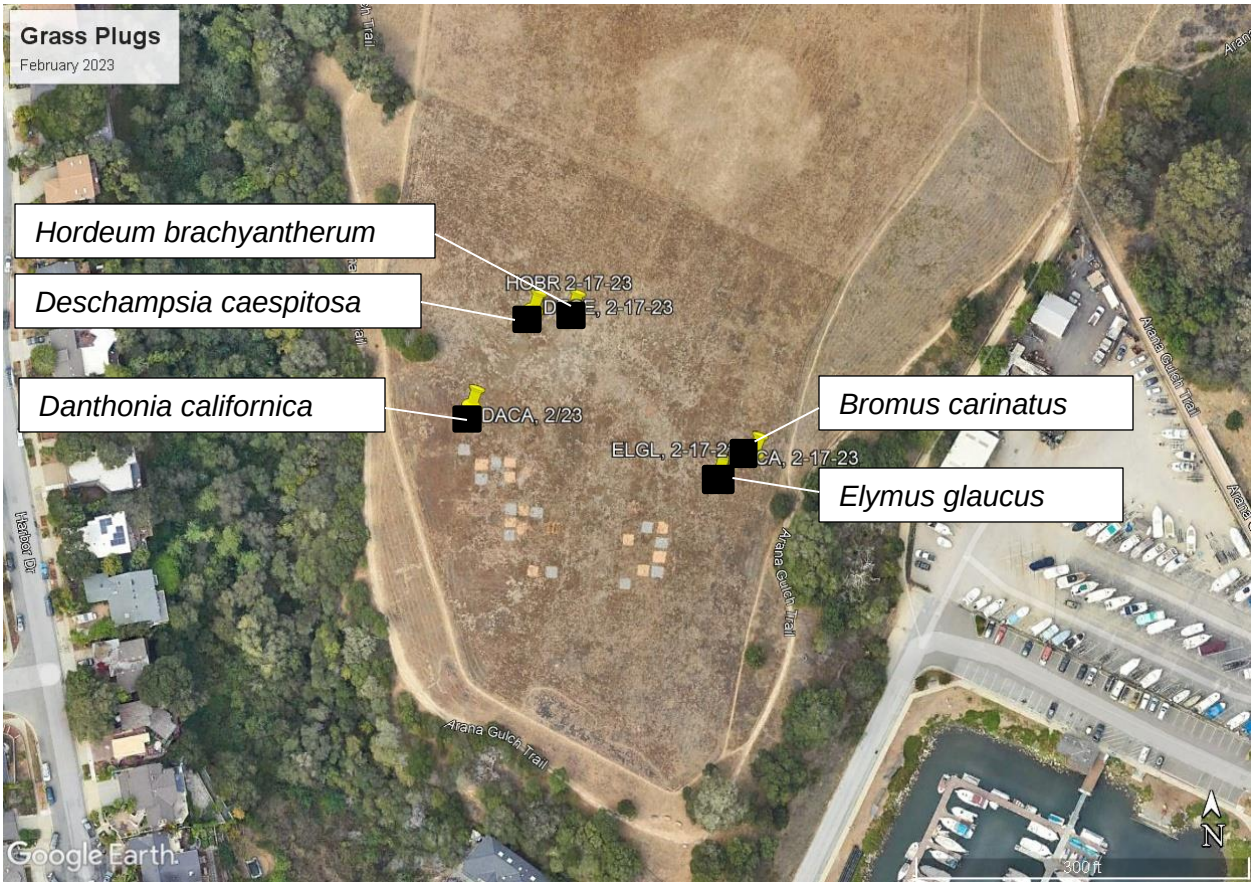


Figure 26. Location of Grass Plug Plantings, February 2023

5.2.3 Vegetation Assessment

5.2.3.1 Monitoring Methods

The 2024 vegetation assessment utilized the point intercept method on 25-meter transects to assess changes in plant species cover and ground cover. In spring (April), a total of 25 sample points per transect were recorded to obtain percent cover of each species encountered by the sampling rod. Ground cover (litter/thatch, bare, basal vegetation) was also recorded. The average height of the canopy layer was measured at the 6, 12, 18, and 24-meter marks using a wire rod (recorded at the height where the vegetation hits the rod). Canopy height measurements were also taken along these transects in February and December to capture winter conditions for the current growing season. At each spring monitoring a photo is taken at the 0-meter end looking along the length of transect with a whiteboard held up at the 5-meter point labeled with the transect number and date. The spring season transect photos are included in **Appendix B**. In addition to the point intercept data, a search is conducted within a 5-meter belt transect (using the transect as the centerline) to record the presence of any

plant species not encountered on the transect. This additional method is often used to capture uncommon or rare species and more fully characterize species richness.

Transect ends were initially marked with rebar posts fitted with metal rebar caps imprinted with the transect ID- however, by 2023 only a few markers remained visible. The GPS location of each end had been recorded along with the compass bearing of the transect from the 0-meter end and this GPS data was used to locate the transect points in 2024.

The original transects were set-up in 2013 and were located using a stratified approach to achieve a representative sample across the coastal prairie. In Area A, 11 transects were established, five were established in Area C, and four established in Area D, for a total of 20 transects. For several years, only four transects have been monitored in both Area C and D, due to the low species diversity and lack of native species. In coordination with discussions with the AMWG, the location of some transects was changed to better reflect vegetation patterns, particularly areas supporting native perennial grasses. In 2023, one transect in Area A North was moved to Area A South, and two additional transects were added in Area A South, as shown in **Figure 27.** In addition, a few transects were re-positioned to capture patches of perennial grass that have been missed in previous sampling. Transects AT 1-4 are now located in Area A North in an area designated as 'annual grassland'. Transect AT 4 was moved to include part of the seasonal wetland that has been mapped for many years (shown in green on **Figure 27**). AT 9 was moved to Area A South. Transects AT 5-13 are in an area designated as coastal prairie. AT 6 and AT 9 were positioned to include two patches of California oatgrass (*Danthonia californica*), shown in blue on **Figure 27**. AT 12 and AT 13 were installed south of the SCT outplantings in an area with high cover by purple needle grass (*Stipa pulchra*).

For analysis, the transect is the sample unit and both absolute and relative percent cover were calculated for each species encountered on the transect. The total number of species encountered on each transect was also calculated as well as bare ground. Cover values were also summed on each transect by guild: exotic annual forb (EAF), exotic annual grass (EAG), exotic perennial forb (EPF), exotic perennial grass (EPG), native annual forb (NAF), native annual grass (NAG), native perennial forb (NPF), and native perennial grass (NPG).

Figure 27. Permanent Transect Placement in Area A North, Area A South and Areas C and D, April 2024

Note: The interior polygons represent native perennial grass patches (green=*Elymus triticoides* wetland, white= *Stipa pulchra*, blue= *Danthonia californica*.

Photo Monitoring. Photo points for long-term monitoring were established in April 2015. A total of 15 points are distributed throughout the coastal prairie with two additional points on the Arana Creek Causeway and two on Hagemann Bridge (**Figure 28**). All points are located at either an interpretative sign or a fence corner for easy reference. Four photos are taken per point in a clockwise order facing into the enclosure; Photo 1 looks straight ahead, Photo 2 is to the right, Photo 3 looks straight behind, and Photo 4 to the left. All photos can be taken in about one hour, preferably when the sun is high in the sky and casting few shadows. The two points taken on the causeway looking into Arana Creek give a general idea of conditions in

the riparian area. The additional points located on Hagemann Gulch Bridge look out and down into the Gulch. One extra point is taken standing in front of the entry sign at Frederick Street in order to observe the recovery from the construction.

Photos were taken in April 2024 and are presented in **Appendix B.**

Figure 28. Location of Photo Points for Long-term Monitoring.

5.2.3.2 Monitoring Results

Precipitation Conditions. Table 4 presents monthly rainfall data for 2013 to 2024 as measured at the DeLaveaga weather station, located just north of Arana Gulch. In most years, rainfall has been below the long-term average of 30 inches reported for the Santa Cruz area (Western Regional Climate Center). In 2023, there was above-average rainfall and in 2024 the yearly rainfall was above average. There was significant rainfall in December and January and the total of 34.82 inches for the water year was above average.

Table 4. Monthly Rainfall (inches) at Sta. 104 (Delaveaga) for the 2013-2024 water years.

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
2013	0.11	5.97	8.96	0.92	0.32	1.7	0.88	0.04	0.12	0.04	0.05	0.14	**19.25**
2014	0.06	0.31	0.12	0.02	3.16	1.4	0.45	0.04	0.05	0.16	0.02	0.96	**6.75**
2015	0	3.16	11.75	0	0.01	0	0	0.09	0.05	0.06	0.01	0	**15.13**
2016	0.04	3.38	5.36	12.92	0.17	0.31	0.72	0.24	0.03	0.06	0.13	0.07	**23.43**
2017	5.79	2.56	8.26	16	14.1	4.95	3.38	0.08	0.17	0.03	0.02	0.12	**55.46**
2018	0.07	2.85	0.17	6.11	0.3	6.67	1.33	0.04	0.04	0.04	0	0.04	**17.66**
2019	0.12	5	3.7	7.75	5.08	7.01	0.85	3.26	0.15	0	0.04	0.17	**33.13**
2020	0.01	2.78	10.76	2.89	0.01	3.3	2.98	1.52	0.04	0.08	0.04	0	**24.41**
2021	0	1.0	2.6	8.2	1.4	2.7	0.3	0.02	0.08	0.02	0.01	0.01	**16.34**
2022	5.54	2.18	9.7	0.74	0	1.17	1.81	0	0.18	0.02	0.03	0.98	**22.35**
2023	0	2.72	8.09	12.2	5.59	10.06	0.34	1.29	0.16	0.01	0.06	0.13	**40.65**
2024	0.04	0.65	7.32	10.22	7.56	6.31	1.61	0.94	0.02	0.02	0.05	0.09	**34.82**

Source: California Department of Water Resources (DWR) California Irrigation Management and Information System (CIMIS) https://cimis.water.ca.gov/WSNReportCriteria.aspx).

Vegetation Assessment Results. The spring vegetation assessment was conducted on April 1 and 2. The 2024 data was compared to sampling data from 2023 as well as the baseline year of 2015. A comparison with the 2015 data is not ideal because it was an extremely dry year. 2023 was above average rainfall year as was 2024 (see **Table 4**).

Canopy Height. The HMP Objective 3A is to reduce canopy height between the months of November thru April to 5 to 8 cm (2-3 in). This target is intended to increase the amount of light penetrating the ground and increase the ability of SCT seed to germinate.

Canopy height measurements in February 2024 were conducted when four cows were in Area A North. Average canopy height in Area A North was 6.8 cm. Area A Southwest had been grazed by four cows (just removed at time of measurement) and canopy height was 6.2 cm. These heights are within the HMP target zone. Area A Southeast was not subject to grazing and canopy height was 22.2 cm. Areas C and D had no grazing to date and canopy heights were 14.6 cm. and 19.7 cm, respectively. By April, after an above average rainfall season, significant vegetation growth has occurred and canopy height was above target in all areas. In Area A north, canopy height was 11.6 cm. Area A Southwest canopy height was 14.5 cm and Area A Southeast was 35.2 cm (**Table 5**). Canopy height in Area C was 14.9 cm and Area D was 34.1 cm. Cows were present in Areas C and D at the time of the April measurement. No cows were in Area A (all pastures). Grassland management (mowing) was implemented in Area A Southwest and Southeast in mid-April, following the monitoring. This mowing (use of rotary mower set at approximately six-inch mow height) reduced canopy height in these

two pastures. Two areas with purple needlegrass were excluded from the management mowing.

Canopy heights were measured again in December 2024. Cattle were present in Area A north and Southwest (gate open between pastures) for approximately one month. Average canopy height in Area A north was 7.1 cm; however, canopy height in Area A Southwest was 19.5 cm. Area A Southeast was measured at 18.1 cm. Area C was 8.2 cm. and Area D was 13.3 cm. Both Area C and D were grazed by cattle in the fall months. Only Area A North and Area C were within target.

Table 5. Canopy Height Measurements, February, May, and December 2024

	Average Canopy Height (cm)		
	February 28	**April 1**	**December 2**
Area A Southwest	6.2	14.5	19.5
Area A Southeast	22.2	35.2	18.1
Area A North	6.8	11.6	7.1
Area C	14.6	14.9	8.2
Area D	19.7	34.1	13.3

[1] Target canopy height November – April is 5-8 cm.

Bare Ground. Objective 3E is to increase the cover of bare ground. In Area A North, average cover of bare ground was 7%, whereas Area A Southwest averaged 17.2% and Area A Southeast was 5%. In Area C, bare ground averaged 4% and Area D bare ground was 2% (**Figure 29**).

Bare ground measurements were also obtained in the SCT-occupied areas in Area A Southwest, Area A Southeast, and Area C (cattle exclosure) in December 2024. Bare ground within eight 1-m^2 quadrats ranged from 0% to 70%; average value was 17.4% (see **Figure 30**). In additional to measuring bare ground, the quadrats found an average cover of 21% by mature SCT plants (range of 10% to 70%) and 6.5% cover by SCT seedlings (range of 0% to 70%). The remainder of the plant cover was comprised of exotic annual grasses and forbs, except for one plot that supported 5% of California oatgrass. Wood chips (present from 2024 and previous-year outplantings averaged 17.4% (range of 0% to 70%).

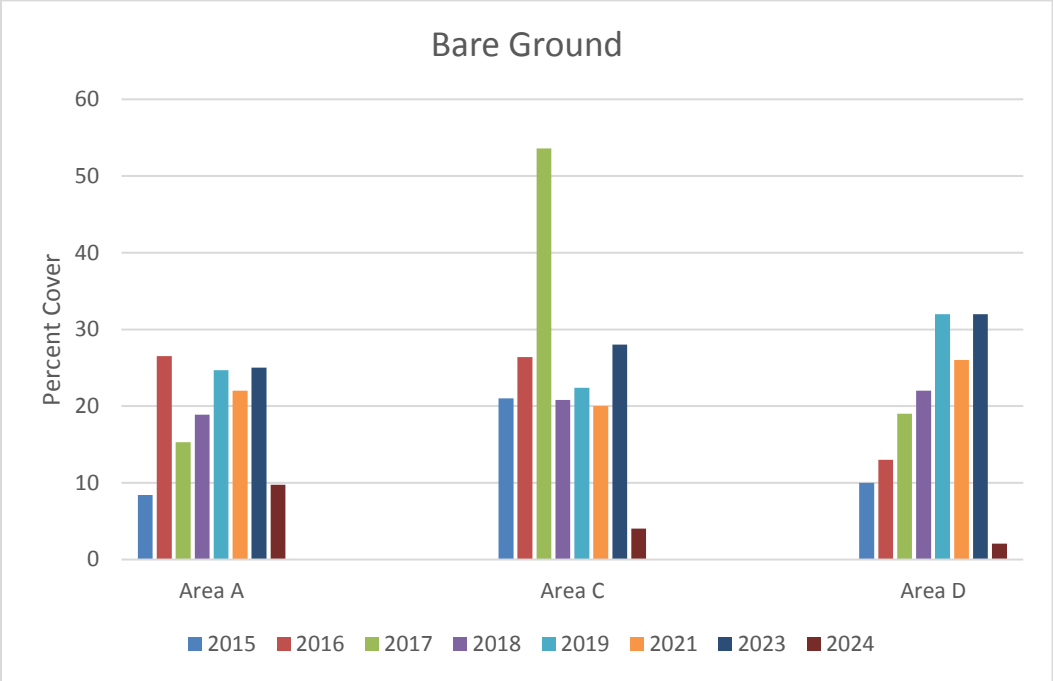


Figure 29. Mean Cover of Bare Ground in Areas A, C, and D, April or May , 2015 - 2024

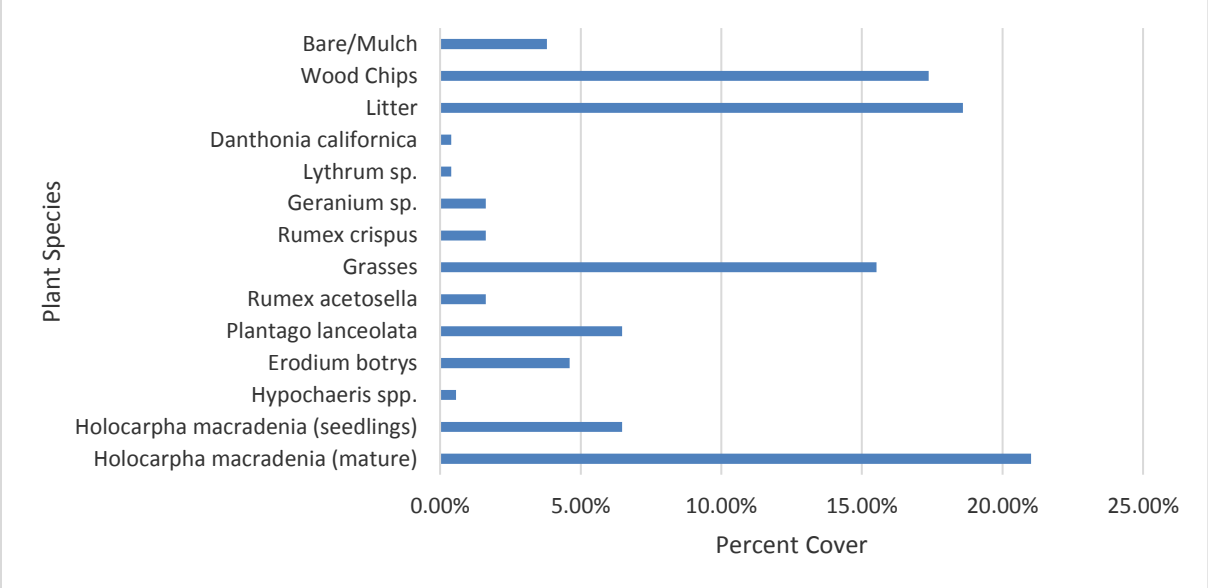


Figure 30. Mean Cover of Bare Ground and Plant Species in SCT-Occupied Areas of Areas A and C, December 2024

Vegetation Cover. Objective 3B is to reduce the cover of non-native species and Objective 3C is to increase the cover of native species. **Figure 31** displays a summary of the cover provided by the various plant guilds in 2024.

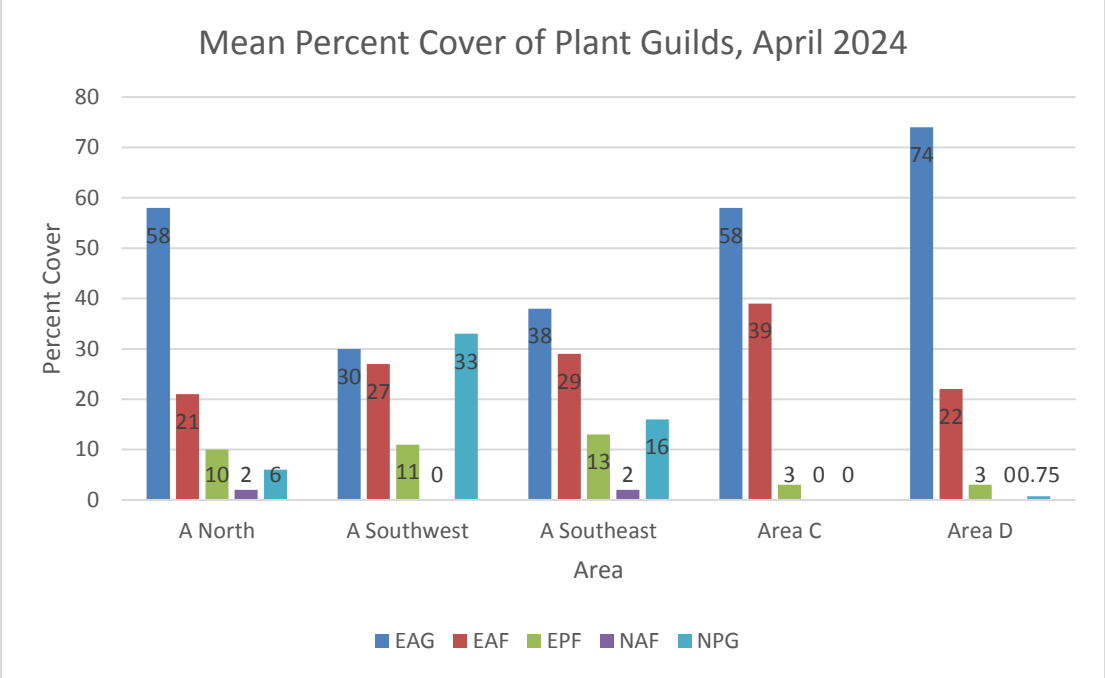


Figure 31. Mean Percent Cover by Plant Guild, April 2024

Area A. Data was collected within the three pastures in Area A.

Within Area A North, exotic annual forbs (EAF) and exotic annual grasses (EAG) continue to dominate the vegetation (**Figure 31)**. The relative cover of EAF is 21% and cover of EAG averages 58%. Cover of exotic perennial forbs (EPF) is 9.5%. Native species cover was provided by California poppy (*Eschscholzia californica)* (NAF, 2%) and creeping wild rye (*Leymus triticoides)* (NPG, 6%).

Within Area A Southwest, exotic annual forbs (EAF) and exotic annual grasses (EAG) continue to dominate the vegetation (**Figure 31)**. The relative cover of EAF is 27% and cover of EAG averages 30%. Cover of exotic perennial forbs (EPF) is 11%. Native perennial grass cover is the highest of all areas of the site, at 33%, with cover California oatgrass (*Danthonia californica)*, spikerush (*Eleocharis sp.)*, rush (*Juncus occidentalis)*, and purple needlegrass (*Stipa pulchra)*.

Within Area A Southeast, exotic annual forbs (EAF) and exotic annual grasses (EAG) dominate the vegetation (**Figure 31)**. The relative cover of EAF is 29% and cover of EAG averages 38%. Cover of exotic perennial forbs (EPF) is 13%. Native perennial grass cover is relatively high at 16%, provided by California oatgrass, spreading rush (*Juncus patens)*,

sedge (*Carex sp.),* and purple needlegrass. Native annual forb (NAF) cover was 2%, provided by California poppy.

Cover by EAF continues to be co-dominated by filaree (*Erodium botrys, E. cicutarium*) and common cranesbill (*Geranium dissectum),* with lesser amounts of subterranean clover *(Trifolium subterranean*). Most EPF cover is provided by rough cat's ear (*Hypochaeris radicata*), sheep sorrel (*Rumex acetosella),* and English plantain (*Plantago lanceolata)*.

Figure 32 (a and b) presents data from the Area A South and North transects with the percent cover of native grasses in 2024. Native cover in Area A South averaged 25% in 2003 and 19.6% in 2024, with most cover provided in Area A Southwest. In Area A Southwest, most native grass cover was provided by California oatgrass *(Danthonia californica)* (20.3%) and purple needlegrass (*Stipa pulchra)* (11.7%). In Area A Southeast, native grass cover is lower (16%), comprised of purple needlegrass (5.2%), California oatgrass (0.9%) and lesser amounts of sedge (*Carex sp*.), rush (*Juncus patens)*, and spikerush (*Eleocharis sp.)*. Creeping wild rye (*Leymus triticoides)* occurs in Area A North (transect AT4). Grazing has been excluded within Area A south since the installation of the SCT outplanting in 2020. Mowing has been implemented, but several patches of purple needlegrass have been excluded from the mowing. EAF cover continues to be high in both Area A north and south, averaging 19%, primarily supplied by wild oat (*Avena s.)*, Italian ryegrass (*Festuca perennis)*, and soft chess (*Bromus hordeaceus)*.

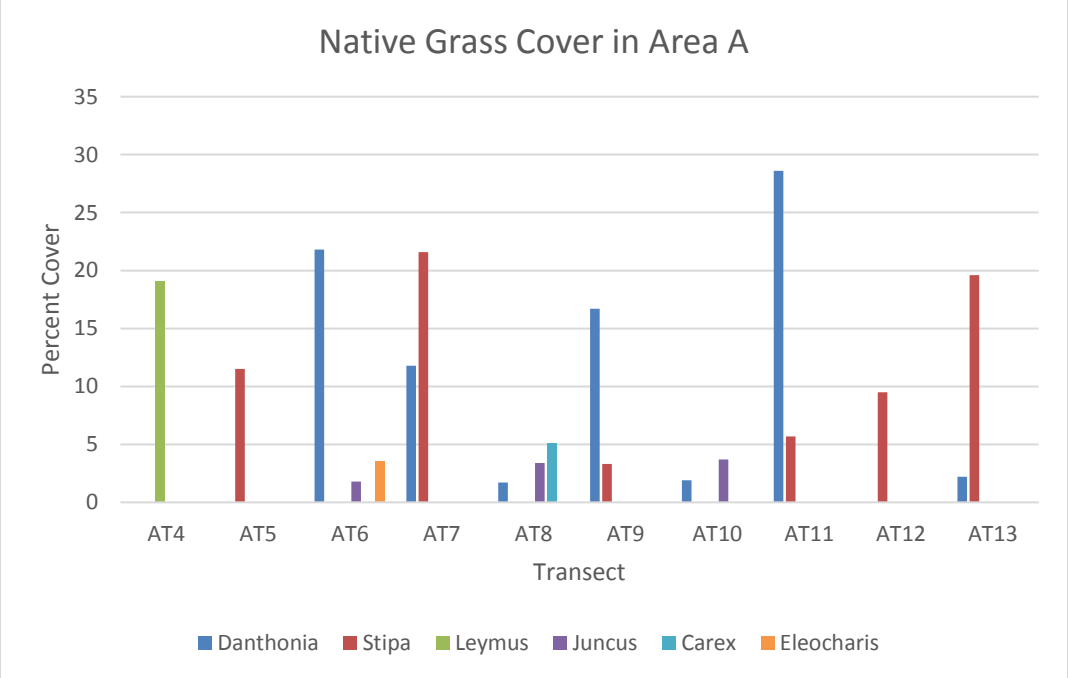


Figure 32a. Mean Percent Cover of Native Grasses in Area A South and Area A North

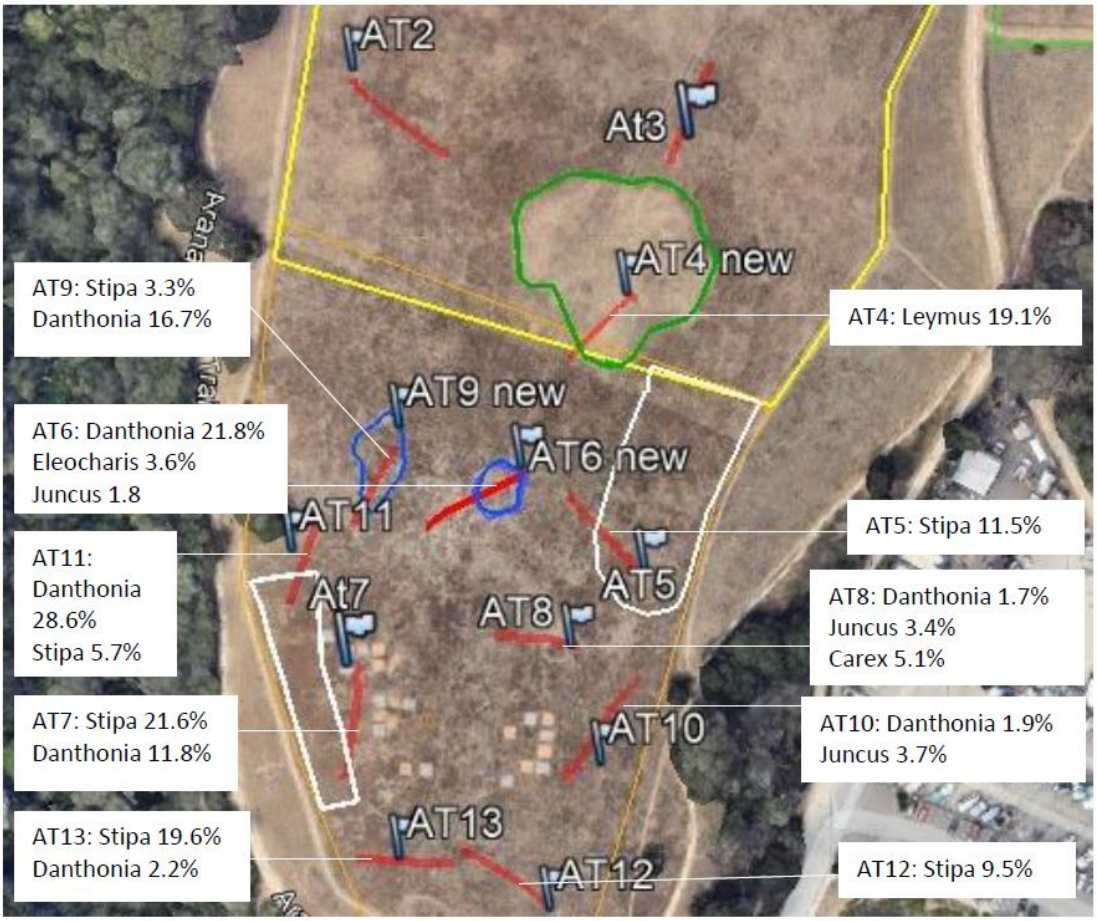


Figure 33b. Mean Percent Cover of Native Grasses in Area A South and Area A North

Comparing the 2004 data on native grass cover within Area A to the study of 37 restored coastal grasslands in California (Luong, J., Press, D., and K. Holl 2023) wherein a performance metric of a minimum of 25% native cover and five native species as the measure of restoration success, Area A Southwest would meet the NPG cover metric (33%), however, native species richness is low, only 2-3 species.

Within all of Area A, average total species richness varied from 4 to 14 species. Area A Southwest exhibited 8 to 11 species, with 2- to 3 species being native. Area A Southeast exhibited 11 to 14 species, with 2- to 3 species being native. in the non-native annual grassland. These data are similar to previous years, as shown on **Figure 33 and Figure 34**).

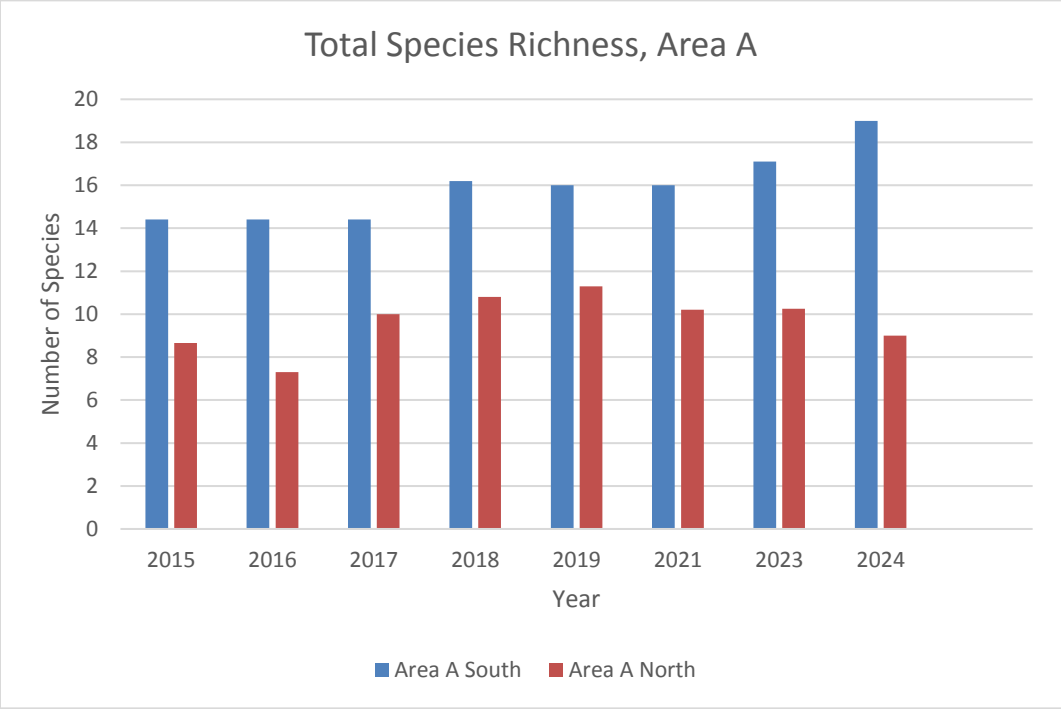


Figure 34. Mean Species Richnesss in Area A South (prairie) and Area A North (grassland)

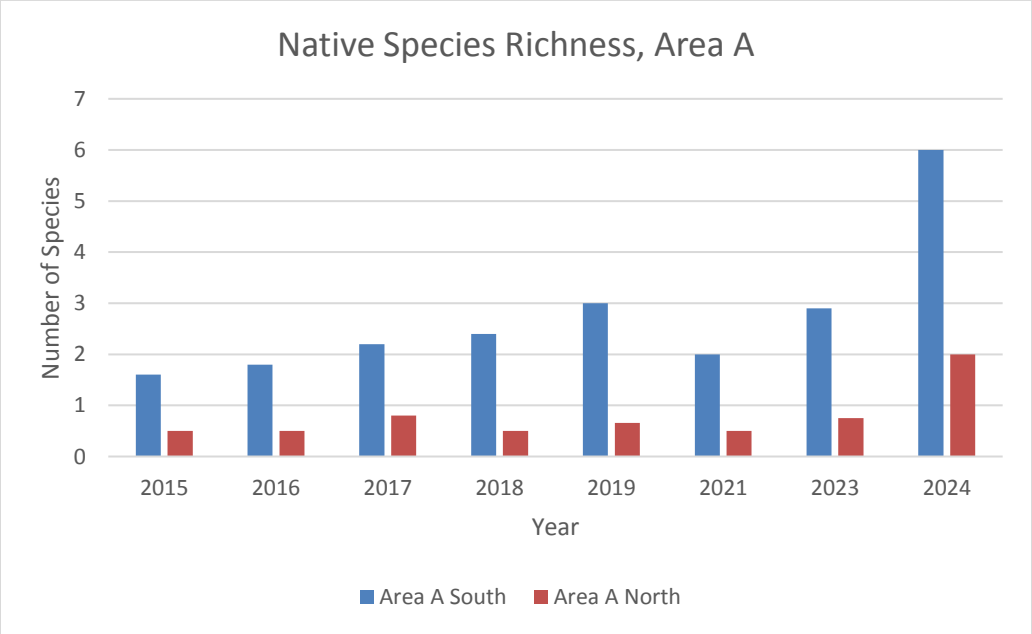


Figure 35. Mean Native Species Richness in Area A South (prairie) and Area A North (grassland)

Area C. Area C remains dominated by non-native species. Relative cover by EAG averages 58%, followed by EAF (39%) and EPF (3%). Most EAG cover continues to be provided by wild oat and rattail fescue (*Festuca myuros)*, and lesser amounts of ripgut brome (*Bromus diandrus)*. Cover by EAF is by filaree, geranium, and lesser amounts of smooth cat's ear (*Hypochaeris glabra)*, Italian thistle (*Carduus pycnocephalus*) and subterranean clover. Native species are still not present in measurable quantities

Vegetation composition in Area C has shifted since grazing began in 2015. Prior to 2023, the most noticeable change was the significant reduction wild radish (*Raphanus sativa*); yet since grazing, cover by filaree increased and provides 29% of plant cover. Wild oat and rattail fescue provide 30% and 18% cover, respectively and while that can create a thick litter/thatch layer, cattle grazing reduces the thatch, with bare ground averages 4%.

Species richness in Area C has increased since grazing began in 2015, from 7 species to 13 species in 2019, then dropping to 10 species in 2023 and 5 to 7 species in 2024 (**Figure 35**). All species continue to be non-native. Although not detected in the transects, spreading rush and SCT (in planted plots) were the only native species visually seen in Area C in 2024.

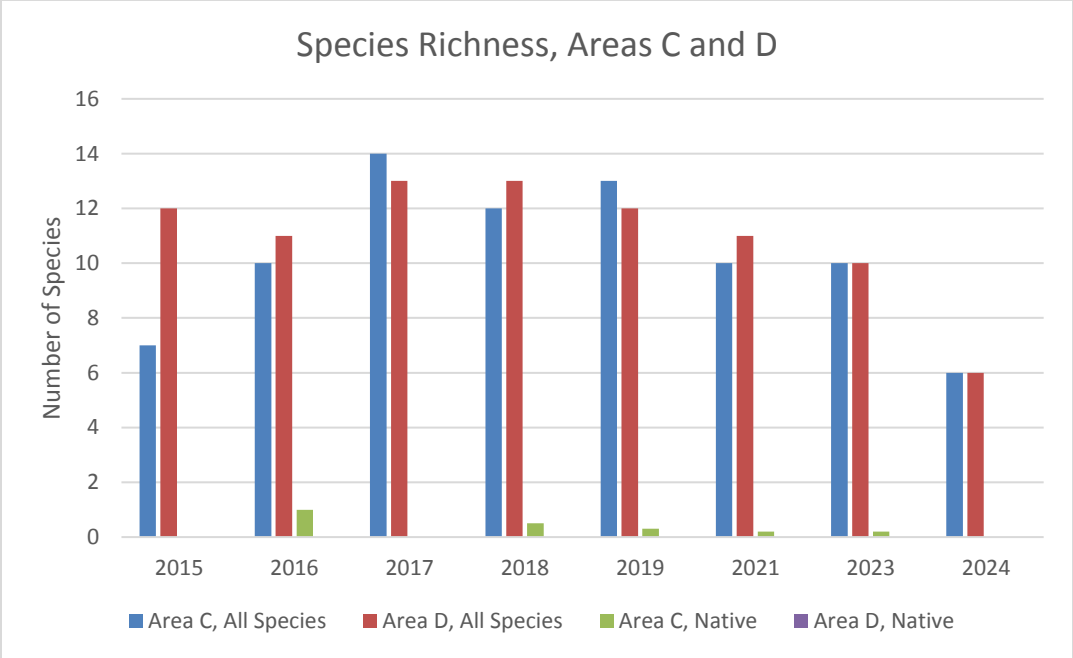


Figure 36. Species Richness in Areas C and D

Area D. Area D is dominated by non-native grass and forbs. EAG cover averages 74% and is provided by wild oat and lesser amounts of soft chess, and ripgut brome. Cover of EAF averages 22%, provided by filaree, geranium, and subterranean clover. Cover of EPF is

mainly sheep's sorrel (*Rumex acetosella)*, with lesser amounts of rough cat's ear. NPG cover was limited to spreading rush (0.75%).

Sampled species richness in Area D ranges from 4 to 9 species, a decrease from 10 to13 species in previous years. Spreading rush has been only native species that has been measured on the point intercept transects.

5.3 Grazing and Stocking Program

5.3.1 Implementation

The installation of the initial cattle grazing infrastructure was completed in February 2015 creating three pastures. The total grazing area is about 18.75 acres (8.4 hectares) and is divided as follows: Area A = 15 acres (6 ha[6]); Area C = 4.1 acres (1.6 ha); and Area D = 2.1 acres (0.9 ha).

Although fences were installed in 2014, a ramp from Agnes Street to the holding coral and water hook-ups for the troughs were completed in February 2015. Large "Cattle Grazing Area" signs were installed at the three trail entrances; smaller signs were installed on the fence posts where trails are in close proximity to the grazing area. Additional signs indicating that the cattle graze to help restore the SCT were installed in February 2016. The City received input from the AMWG on the language for these signs. In 2017, a gate was added in Area C to facilitate movement of animals between areas A and C. In 2022, an east-west cross-fence was installed in Area A. This fence created Area A North and Area A South pastures, which allowed cattle grazing in Area A North while SCT outplantings occurred in Area A South. In January 2024, a north-south cross fence was installed in Area A South. This cross-fence allowed for more focused management in Area A South. Specifically, Area A Southwest was grazed in January -February 2024 and November-December 2024, while cattle were excluded from Area A Southeast where SCT outplanting occurred. All fences, access gates, and other features to support cattle grazing were inspected and maintained throughout 2024.

The City's grazing contractor had cattle onsite all year (January 1 through December 31). The grazer used a cow/calf program. The HMP's original estimate for cattle was 2 to 6 cow calf pairs. However, it became evident during previous grazing years that this number of cattle was insufficient to keep up with the rate of grass growth. As an adaptive management action, the AMWG revised its recommendation to the City to provide the City and the rancher with more flexibility to increase the number of cattle at the site to keep pace with grass growth. The specific number of cattle present onsite throughout the 2024 grazing season are presented on **Table 6**.

[6] In 2021 and 2022 only the northern portion of Area was grazed.

As grazing occurred in 2024, the City conducted numerous observations of grazing operations, including the entry and exit of cattle from the site, conferring with the grazing operator, observations of feed and water troughs (regularly during the grazing season), recording residual dry matter (RDM) and adherence to BMPs (see Section 3.5.6 in HMP).

Table 6. Duration of Cattle Grazing, 2024

Duration	# of Cattle in Area A North	# of Cattle in Area A SW	# of Cattle in Area C	# of Cattle in Area D	# of Cattle in Areas C & D (open gate)	# of Months Grazed
January 1 February 2	3 cows 1 calf		-	-	-	1.0
February 2-March 15	3 cows 1 calf[7]		-	-	-	1.5
March 15 – March 26	-	-	-	-	3 cows 1 calf	0.3
March 26 – May 3	-	-	-	-	6 cows 5 calves	1.2
May 3 – June 1	6 cows 5 calves	-	-	-	-	1.1
June 1 – July 27	-	-	-	-	7 cows 5 calves	1.7
July 27 September 5	7 cows 5 calves	-	-	-	-	1.3
September 5 – October 30	-		-	-	3 cows 3 calves	1.9
October 30 – November 10	-		-	-	2 cows 2 calf	0.3
November 10	-		-	-		0
November 10 - December 31	4 young cows		-	-	-	1.7
Total						**12**

5.3.2 Monitoring

Residual dry matter (RMD) is the amount of dry plant material left standing or on the ground from the previous year's growing season (Bartolome *et al*. 2006). RDM includes three components: 1) the current year's crop of palatable forage, 2) non-palatable plants, weeds, and the stubble of dry matter that is left behind when clipping and 3) thatch, which is dead plant material greater than one-year old. *A Mulch Manager's Guide for Monitoring Success* (Wildland Solutions 2008) provides practical information on how to assess RDM in a manner that is objective and directly related to management objectives for rangeland health. The RDM monitoring was conducted on October 3. Pursuant to the methodology outlined in *Guidelines for Residual Dry matter on Coastal and Foothill Rangelands in California* (UC

[7] Gate is open between Area A North and Area A Southwest

Publication 8092 by J. Bartolome) the grazing areas were walked along random transects. Equipment consisted of a clip and weigh RDM kit from Wildland Solutions that included a 13.25" diameter circular hoop plot, a gram scale, and measuring bag. The RDM plot was randomly tossed and the vegetation was clipped and weighed. A photo was obtained of each plot before and after clipping; noting plot number, RDM level and date on dry erase board. The measuring bag was weighed empty, summer annual plants and any tree leaves were removed from the clip plot; old thatch was not evident and not included. Plants rooted in the plot were clipped as close to the ground as possible, clippings were placed in the bag, weighed and recorded (subtracting weight of the bag). The weight of the clippings was converted to pounds per acre (grams clipped x 100 = lbs./acre RDM).

Clipping and weighing RDM plots was used to calibrate visual estimates of three RDM levels corresponding to an RDM objective of 500-650 lbs./acre (exceeds, meets, or below). Once the observer's eyes were calibrated, it was possible to assess the RDM level without a clip plot. Locations where RDM levels were assessed as well as edges of mapped boundaries were recorded with GPS waypoints.

The results were plotted onto an aerial photo to create an RDM zone map, based on GPS points mapped onto most recent Google Earth imagery available, and polygons created. The RDM zone map, portraying the following RDM levels, provides a sufficient level of detail for aiding management and cattle grazing decisions:

BLUE: Highest RDM (exceeds objective (>650 lbs./acre)
GREEN: Middle RDM (meets objective (500-650 lbs. per acre)
RED: Lowest RDM, below objective (<500 lbs./acre)

5.3.3 Results

Within the grazed areas (Area A North) RDM levels were equally reflected by red (<500 lbs./acre), green RDM (500 - 650 lbs./acre), and blue RDM (>650 lbs./acre) zones, which reflects the effects of seasonal grazing that occurred in 2024, as well as the amount of biomass produced in the above-average rainfall year. At most locations, thatch was not evident as cattle ingested the current and previous year's growth. All areas had higher RDM levels compared to 2022, which is likely attributable to the abundant plant growth in 2023.

Figure 36 exhibits the RDM map for the grazed areas. **Figures 37, 38** and **39** show clip plots with highest RDM (>650 lbs./acre), middle RDM (500-650 lb./acre) and lowest RDM (<500 lbs./acre), respectively.

Figure 37. RDM Map for Grazing Areas, October 2024

Figure 38. Clip Plot of Highest RDM (Blue), October 2024

Figure 39. Clip Plot of Middle RDM (Green), October 2024

Figure 40. Clip Plot of Lowest RDM (Red), October 2024

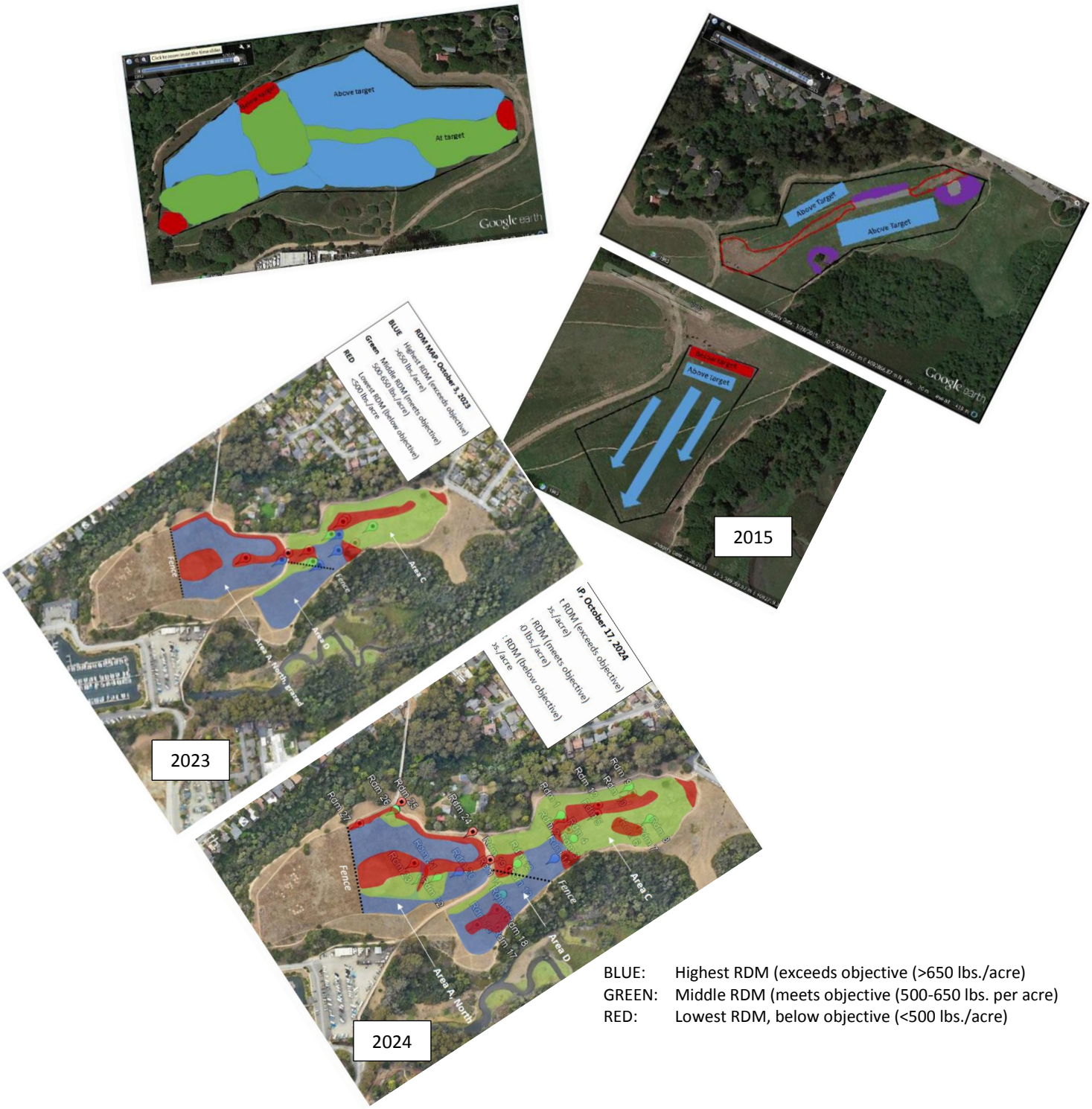
5.3.4 Discussion

In 2024, cattle grazing reduced canopy height in Area A North and Areas C and D during months the cattle were on site (all year, January 1 through December 31). In addition, short term cattle grazing in Area A Southwest in late January – February affected canopy height in February 2024. Grazing canopy height in mid-February averaged 6.8 cm. in Area A North, and 6.2 cm. in Area A Southwest. Areas not yet grazed had taller canopy heights; 14.6 cm. in Areas C and 19.7 cm. in Area D. The canopy height in Area A North and Areas A Southwest was within the desired target range for the SCT germination and emergence period (i.e., 5-8 cm.), yet was above target in Areas C and D.

Similar to previous years, once grazing was initiated, the cattle reduced biomass across the grassland and in the process also increased bare ground. Non-native species remained dominant. A comparison of RDM levels between 2015, 2023, and 2024 is presented in **Figure 40**.

There were more areas of low and middle RDM zones (red and green) in 2024 than 2023. There is more low RDM (red) zones area in all areas, compared to 2023. Both years had above-average rainfall and abundant grass growth; yet additional grazing efforts were implemented to reduce growth and represents positive progress in improving vegetation conditions. As the Arana Gulch grasslands have been highly disturbed for well over one hundred years, returning the grassland and prairie to reference conditions, if possible, will take many more years.

Figure 41. RDM – Comparison of 2015, 2023, and 2024 Measurements



5.4 Invasive Weed Work Plan

5.4.1 Management Actions

In 2015 the City mapped the invasive plants within this management area and prepared an Invasive Weed Work Plan (IWWP). In 2016, the City filled a park maintenance position with dedicated hours for Arana Gulch. The IWWP outlined methods for the removal and control of invasive, non-native plant species in the management area. Species addressed in the plan include: Italian thistle (*Carduus pycnocephalus)*, bull thistle (*Cirsium vulgare)*, poison hemlock (*Conium maculatum)*, cotoneaster (*Cotoneaster sp.)*, Bermuda grass (*Cynodon dactylon)*, French broom (*Genista monspessulana)*, English ivy (*Hedera helix)*, velvet grass (*Holcus lanatus)*, Harding grass (*Phalaris aquatica)*, *Prunus sp.*, pyracantha (*Pyracantha sp.)*, wild radish (*Raphanus sativa)*, Himalayan blackberry (*Rubus ameniacus)*, and milk thistle (*Silybum marianum).* The IWWP is presented in the Year 2 Annual Report, Appendix B.

In 2024, the City and volunteer groups removed invasive plant species from the delineated grassland area. Thickets of Himalayan blackberry, Italian thistle, and milk thistle were mowed or weed-whipped. Control actions for thistles in the IWWP, specify that when seed heads of thistles are observed, they are cut and disposed of off-site. Thistles (*Cirsium, Silybum,* and *Carduus spp.)* were previously widespread on site and control efforts have significantly reduced cover of these species.

5.5 HMP Performance Evaluation

The purpose of the detailed vegetation monitoring is to assess progress toward meeting the goals and interim success criteria specified in the HMP.

- Goal 1: Increase the abundance and distribution of the SCT population.
- Goal 2: Restore a proper disturbance regime with the reintroduction of grazing.
- Goal 3: Minimize the detrimental effects of high non-native cover and restore coastal prairie species diversity and habitat function.
- Goal 4: Increase the size of the SCT seed bank to a level that will ensure a high probability of persistence for 100 years, or in perpetuity.

The HMP made the assumption that an introduction of grazing in 2015 would create site conditions conducive to increasing the abundance and distribution of SCT (Goal 1) by providing a disturbance regime needed for the species. While the grazing program has successfully reduced average canopy heights and increased bare ground, it has not reduced cover of non-native plants or increased native species richness or cover (Goal 3), nor increase the abundance and distribution of SCT (Goal 1) of its seed bank (Goal 4). The grazing release in Area A South in 2021 allowed for an increase in cover by native perennial grasses

of California oatgrass and purple needlegrass (*Stipa pulchra)*. The large stands of purple needlegrass are avoided during the season spring mowing in Area A South allowing for good growth and seed set of this species. Recent research on restored prairies in the central coast documented reference data on native plant cover and species richness. Using this reference data, the Area A Southwest grassland/prairie has met one metric in the definition of a restored functioning coastal prairie system as specified by Goal 3. This metric is native perennial grass cover. However, the number of native species (native species richness) is below the required metric.

The lack of natural recruitment of SCT on site following years of cattle grazing confirmed the depletion of the SCT and other native species seedbank, indicating that the SCT population could be at or near some unknown threshold of extirpation at the site. Due to these concern on species extirpation, in 2021 management actions were refocused to species recovery through re-establishment of a viable soil seedbank. In 2021 an outplanting program was developed to introduce SCT seed to the site to meet Goals 1 and 4. Due to the initial success of SCT plant propagation and outplanting in 2021, the outplanting program was repeated in 2022, 2023, and 2024. The program has successfully re-introduced SCT plants and seed into the ecosystem, resulting in two generations of natural SCT plant recruitment. To date, a more than a hundred thousand SCT seeds have been introduced to the site to recreate/rebuild a SCT soil seedbank (Goal 4). Goal 4 is to maintain a viable SCT population, with an objective (1A) to increase the number of aboveground SCT to at least the 2006 level (348 plants) in the first year after the return of grazing (i.e., summer 2016) (Objective 1A). Although no SCT were observed in the first year after grazing (2022), the 2021-2024 outplanting program has resulted in hundreds of SCT plants on site, exceeding the 2006 level of 348 plants. In 2024 4,141 SCT plants occur on site. These plants represent current year outplants (1,007 plants, 24% of population) as well as SCT plants arising from viable seed in the soil seedbank (i.e., in historic colony sites and previously-planted areas (3,134 plants, 76% of population). The HMP objective to increase the population above the 2006 level has been attained for last three years (2022 -2024).

A second HMP objective (1B) is to expand the distribution of SCT beyond Area A within three years. In 2021, 2022, 2023 and again in 2024, SCT were installed in Area C within a cattle exclosure. Although seed was released into the soil from these plantings, there was no natural recruitment of SCT plants from these outplantings. In 2024 302 SCT plants survived from the years outplanting, contributing approximately 9,000 flowerheads and over 100,000 seeds into soil seedbank. Management actions were implemented to encourage natural recruitment, including spring weeding and fall/winter cattle-grazing/activity. Continued SCT outplantings in Areas C is recommended for 2025. The City entered another agreement with UCSC Greenhouses to propagate SCT plants for outplanting in Areas A and C in 2025.

The HMP has a goal to maintain a genetically and demographically viable soil seed bank in perpetuity (Goal 4), with an objective to increase the density of viable ray achenes in the soil

seed bank from the baseline (first 3 years) and conduct assessments at 5-year intervals (Objective 4A). As discussed in the Year 2 (2015) Annual Report, a baseline seed bank density study was conducted by Dr. Bainbridge in 2014 /2015 that demonstrated a 100-fold decline from data collected in 1999. Additional soil seed bank density analysis has not been conducted. Such a study may be warranted after several years of outplanting such that an updated seed bank density can be documented.

To maintain a viable seed bank and to guard against an unexpected stochastic event, SCT seed was collected from the site in 2018 (seed from 25 flower heads collected from 267 plants) and deposited at the UCSC Greenhouse for long-term seed storage. Under an agreement with the City and UCSC, approximately 100,000 additional seeds were produced through a seed bulking effort This seed increase is one tool to maintain a genetically and a demographically viable seed bank, which could be used at a later date to enhance the soil seed bank.

A goal of the 2021-2024 SCT outplanting program is to further increase SCT seed input into the soil seedbank. The seedbank consists of both the disk and ray seeds. The disk seeds can germinate within a year of release whereas the ray seeds may not germinate for several years. The *Germination Study: Dormancy in Ray Achenes of Holocarpha macradenia* (Childress, 2023) found the average viability of the ray achenes at 40% and under field conditions, scarification of the ray achene seed costs and/or the seed's exposure to light, may be the most likely triggers for germination. Although it is not known how many viable disk and ray seeds are produced per plant, an estimated 160,000 SCT flowerheads, with possibly a million or more seeds, have been released into Area A South and a portion of Area C from the 2021-2024 outplantings, thus contributing to the HMP goal.

The HMP has three goals that apply to the coastal prairie and are not specific to the SCT (which is addressed in the previous section). Goal 2 seeks to maintain a functioning coastal prairie through the reintroduction of grazing and the resultant disturbance regime. Objective 2A identifies implementation of the grazing program by 2014 and Objective 2B requires that the grassland achieve residual dry matter (RDM) measurements within a range appropriate for SCT growth. Seasonal grazing was continued in the northern portion of Area A, Area C and Area D in 2024 and many areas of the grazed areas were in the red and green RDM range, thus, meeting Objectives 2A and 2B. The City elected to continue another year of excluding cattle from Area A South in 2024 to accommodate the continued SCT outplanting program, as the outplantings might have been adversely affected by cattle activity. Both the Southwest and Southeast pastures of Area A south were mowed in the late spring and early summer as an alternative grassland/prairie management action. In addition, cattle were allowed to graze Area A Southwest for a short time in January/February to facilitate SCT seed dispersal.

Observations and BMP implementation monitoring of the grazing program in Area A North and Areas C and D were implemented concurrent with grazing. The protocol for monitoring of the grazing program in 2024 are outlined in the HMP and include observations of feed and water troughs (3 times during grazing), adherence to BMPs (see Section 3.5.6 in HMP), and documenting residual dry matter (once a year in September or October). The following BMPs, as identified in the HMP[8] , were implemented and monitored:

- Temporary fencing was not needed around the seasonal wetland within Area A or its 50-foot buffer, as no adverse impact from cattle grazing was observed in this area in 2024
- Water troughs were placed adjacent to grazing area gates and away from the top of steep slopes; the troughs were located outside of sensitive areas (occupied SCT areas/seasonal wetland). No supplemental feed was used in 2024.
- The 2024 grazing season was in an above average rainfall year and the number of animals on site did not result in any erosion. There was no significant volume of cattle waste due to the relatively low number of animals on site during the grazing season.
- The City and the grazing contractor conducted regular visual inspections of fence lines to ensure cattle remained within the designated grazing area in 2024 There were no incidents of cut fence lines during the grazing season. The City and the grazing contractor monitored the fences during the grazing season; at no time did any cattle escape the grazing area.
- During rainfall events, the City conducted visual inspections (by foot) to document whether there was any rilling or other erosion within and from the grazing area. No erosion issues were detected in 2024 There was no need to install erosion control measures, such as straw wattles, to prevent any accelerated or channelized runoff toward steep slopes.
- The grazing contractor avoided motorized vehicle use during rainy season/soil saturation.
- Two molasses barrels were placed in Area A Southwest to encourage cattle activity (December 2024).

The observations of SCT in 2024 occurred in Area A South and the small fenced cattle exclusure in Area C. Area A South was not subject to grazing in 2024. The cattle exclusure in Area C with SCT outplantings was opened to cattle grazing in November and December 2024 to facilitate SCT seed dispersal, reduce thatch/biomass, and create bare ground suitable for SCT seed germination.

[8] See page 68 (Section 3.5.6) of Arana Gulch HMP.

5.5.1 Status of SCT Recovery, Years 1-11

At the conclusion of the 11th year of implementation of the HMP, it can be shown that the SCT population has achieved the HMP threshold of 348 plants. This threshold has taken many years and pathways and its continued success is not assured without continued human intervention and site management.

As presented in **Table 7,** the first five years of HMP implementation were focused on grassland management (through cattle grazing) to create suitable habitat conditions for SCT seed germination and plant growth. By Year 6 it was determined that the extant seedbank was too depleted and continuing the grazing program, by itself, was not going to meet the required HMP goals for the species. Habitat management actions were then re-focused on species recovery. Recovery actions included on-site seed collection, seed increase, plant propagation, experimental SCT outplantings, and experimental direct seeding. These actions were implemented over a period of five years, resulting in over 4,000 SCT plants installed and one plot hand-seeded. By the end of 2024, approximately 4,141 SCT plants had flowered at Arana Gulch, comprised of 1,007 plants from the current-year outplanting and 3,134 plants from natural seed recruitment in previously-planted plots and historic areas.

These early stages of SCT recovery have been successful; however, many habitat management questions remain. The next stage of species recovery needs to determine the management that can maintain and/or increase both the SCT population and its areal extent into the future. There are questions on optimum SCT seedbank density and viability, optimum grassland management techniques, as well as the need for long-term seed collection, plant propagation, outplanting, and direct seeding.

Population Maintenance Seedbank Density

- Determine if planting container-grown SCT is a viable method to increase population and maintain/increase soil seedbank.
- What is required seedbank density for long-term preservation of SCT on site; how often should SCT outplanting occur to reach desired seedbank density?
- How much seed production is needed each year to maintain desired seedbank density?

Grassland Management for SCT

- Effect of mowing/grazing on SCT population, including how many above-ground SCT plants are needed to maintain (or increase) SCT population, taking into account herbivory and/or plant/seed losses
- Amount of bare ground needed in winter for SCT seed germination
- Optimum cropping height for SCT to increase branching and subsequent flower and seed production

- Evaluate vectors for seed dispersal and SCT establishing outside of planted plots.

Table 7. Status of SCT Recovery, Years 1-11

Year	Action	Rationale	Results and Recommendations
Years 1-5 (2014-19)	Seasonal grazing, Jan – July (typical)	HMP premise was that there was viable SCT seed in the soil seedbank and that grazing would be suitable management to create soil disturbance and reduce weed cover to stimulate germination of the soil seedbank.	Grazing had no obvious effect on expression of extant SCT seedbank, as SCT occurrences were limited to old, pre-grazed scrape plots. Determination was made that extant seedbank is too depleted for species to recover with just grazing management. In Year 5, it was determined that re-introduction of SCT seed into the habitat is required for species recovery.
Years 5-6 (2018-19)	Collection of on-site SCT seed	Seed increase at UCSC Greenhouses for later outplanting to re-introduce SCT seed into the system	Collection of 24 seed heads from extant plants. Successful seed increase, generating approximately 10,000 seeds, in storage at UCSC Greenhouses. In Year 6, decision was made to conduct experimental SCT plant propagation for outplanting in Year 7.
Year 7 (2020)	Experimental Greenhouse Propagation and Outplanting of SCT	Successful growth of SCT in nursery. Experimental outplanting of 28 SCT Plugs in Area C	Survival of 6 SCT; approx. 200 flowerheads (FH) produces with seed released onto site (Area C). Decision made to increase SCT plant propagation and outplanting for Year 8, using stored seed.
Year 8 (2021)	Nursery Propagation and Experimental Outplanting of SCT	Propagation and outplanting of 1,000 SCT plugs in Areas A, C, and D. Macro-plots used to evaluate various methods of mulch, with and without grazing, and control	60% survival of outplantings in Area A and C; 0% survival in Area D; approx. 52,000 FH with seeds released in Area A and Area C. No natural recruitment of SCT in previous year outplanting site (Area C). Decision made to repeat SCT plant propagation and outplanting for Year 9, using stored seed.
Year 9 (2022)	Nursery Propagation and Experimental Outplanting of SCT Experimental Mowing of Previously Year Plots (Area A)	Outplanting of 1,400 SCT Plugs in Areas A and C, using macro-plots to evaluate various methods of mulch and control. No grazing. Experimental seeding in Area A. Previous year plots in Area A subject to seasonal mowing February – May.	20% survival of outplantings in Area A And Area C; approx. 15,000 FH and seeds released in Area A and Area C. Natural recruitment of SCT in previous year outplanting plots in Area A (1,500 SCT; approx. 4,500 flowerheads with seed released). Mowing caused branching and more flower/seed production on SCT plants tall enough to cut. Decision made to repeat SCT plant propagation and outplanting for Year 10, using stored seed.
Year 10 (2023)	Nursery Propagation and Outplanting of SCT	Outplanting of 1,091 SCT Plugs in Areas A and C, using wood chip and straw mulch plots. No grazing. Previous year	88% survival of outplantings in Area A (874 plants); 81% survival of outplantings in Area C (76 plants); approx. 34,980 flowerheads and seeds released in Area A and 3,040

Year	Action	Rationale	Results and Recommendations
	Mowing of Portion of Previously Year Plots (Area A) Allow fall season grazing in Area C cattle exclosure	plots subject to seasonal mowing February-May and fall season mowing	flowerheads released in Area C from outplanting. Natural recruitment of SCT in previous year outplanting plots in Area A, reflecting F1 and F2 generations and recruitment of SCT in historic natural areas and an experimental seeding plot (958 SCT; approx. 10,518 flowerheads with seed released). Spring season mowing caused branching and more flower/seed production on SCT plants tall enough to cut. Experimental fall season mowing of half of SCT population in Area A South. Flail-mowing and raking of non-SCT occupied areas in Area A South for habitat management. Decision made to repeat SCT plant propagation and outplanting for Year 11, using stored seed.
Year 11 (2024)	Nursery Propagation and Outplanting of SCT into Areas A and C Mowing of Portion of Previously Year Plots (Area A) Allow grazing in Area C	Outplanting of 784 SCT plugs in Areas A and 334 plugs in Area C, using wood chip plots. Previous year plots subject to seasonal mowing April -July	90% survival of outplantings in Area A and Area C; approx. 30,210 flowerheads and seeds released in Area A and Area C. Natural recruitment of SCT in previous year outplanting plots in Area A, reflecting F1 -F_3 generations and recruitment of SCT in historic natural areas (3,134 SCT; approx. 15,300 flowerheads with seed released). Spring and early summer mowing caused branching and more flower/seed production on SCT plants tall enough to cut. Rotary mowing and raking of non-SCT occupied areas in Area A South for habitat management. Decision made to repeat SCT plant propagation and outplanting for Year 12, using stored seed
Year 12 (2025)	Nursery Propagation and Outplanting of SCT (scheduled) Grazing of 2025 plots and Previously Year Plots in Area A Southwest (Scheduled) Mowing in Area A Southeast Allow grazing in Area C	Outplanting of 1,000 SCT Plugs in Areas A and C, using cardboard and wood chip plots. Seasonal grazing with cross-fence in Area A South west. Previous year plots subject to seasonal mowing or grazing January until SCT bolting	To be reporting in Year 12 (2025) annual report.

Table 8. Biological Variables Monitored in Coastal Prairie/Tarplant Management Area

Objective	Variable	Measurement Frequency	Desired Direction of Change	Interim Target Date	Year 11 (2024) Results	Objective Met?
Goal 1. Maintain a viable SCT population at Arana Gulch						
Objective 1A. Increase number of aboveground SCT to at least the 2006 level by 2015 (Note: 2006=348 plants in Area A)	# of above ground SCT plants	Yearly in Aug./Sept.	Increase	2014	4,1,41 SCT in Area A, and Area C	Yes
Objective 1B. Expand the distribution of SCT beyond Area A within 3 years (Note: Year 3 = 2017)	Distribution of SCT plants	Yearly in Aug./Sept.	Expansion	2017	705 SCT outplantings survived in Area C in 2024	Yes
Goal 2. Reintroduce grazing to restore a disturbance regime that maintains functioning coastal prairie						
Objective 2A. Implement the Grazing Program by 2014	2A.1 Observation of feed and water troughs	3x during grazing	Stable	2015	City monitored water troughs	Yes
	2.A.2 BMP implementation monitoring	3x during grazing	Stable	2015	City monitoring plant height and other BMPS through grazing season	Yes, BMPs were implemented
Objective 2B. Maintain RDM within a range that allows SCT to complete its lifecycle and protects coastal prairie grassland from erosion (700-1,500 lbs./acre)	Residual dry matter (RDM)	Yearly in Sept./Oct.	Maintain within range	2017	RDM measured in October; some areas in were at target	Yes, some areas were above target
Goal 3. Minimize detrimental effects of high non-native plant cover and restore coastal prairie species diversity and habitat function						
Objective 3A. Reduce canopy height during the basal rosette stage for SCT (Nov. –	Average canopy height	3x during growing season	Reduction	2015	Canopy heights in Area A North and Area C were at or near target in February, in all; canopy heights were	Partially, cattle grazing reduced canopy height in northern portion of Area A and Area C.

Objective	Variable	Measurement Frequency	Desired Direction of Change	Interim Target Date	Year 11 (2024) Results	Objective Met?
April) from the baseline level to 2-3 inches[9] by 2015					above target in all areas in April; however, Area A north and Area C were within target by December.	
Objective 3Bi. Reduce cover of non-native species in the coastal prairie from the baseline to one more representative of a reference functioning coastal prairie system by 2020	Percent cover of non-native plants	Yearly at peak growth in April	Reduction	2020	Non-native plant species dominate the grassland.	Cattle grazing has altered non-native composition but non-native species dominate the grassland.
Objective 3Bii. Cover of native perennial grasses (NPG) increases from baseline levels to one more representative of a reference intact coastal prairie system"	Percent cover of native perennial grasses	Yearly at peak growth in April	Increase	2020	Grazing exclusion in Area A South appeared to allow several NPG species to flourish. Average NPG cover is 6% in Area A north, 33% in Area A Southwest, and 16% in Area A Southeast. NPG is 0% in Area Ca and 0.75 % in Area D.	No, cover of NPG remains low in Areas C and D; however, Area A North and South have higher cover values. A mowing regime in Area A South has retained native plant cover; an outplanting of native grasses in Area A South was implemented in 2023.
Objective 3C. Increase cover of native species from baseline levels to one more representative of a	Percent cover of native plants	Yearly at peak growth in April	Increase	2020	Cover of native species in Areas A North is 8%, 33% in Area A Southwest, and 18% in Area A Southeast.	No, cover of native species has not increased significantly in Areas C and D; however, native

[9] AMWG reduced threshold from 0.5 m (1.6 feet) to 2-3 inches in January 2015

Objective	Variable	Measurement Frequency	Desired Direction of Change	Interim Target Date	Year 11 (2024) Results	Objective Met?
reference functioning coastal prairie system by 2020.					Area A Southwest is within range of native plant cover for restored coastal prairie as documented by J Luong. Cover in Area C and Area D remains at <1%.	plants are more likely to be encountered in Area A; Area A Southwest meets native plant cover metric for coastal prairie.
Objective 3D. Increase native species richness from baseline levels to one more representative of a reference functioning coastal prairie system by 2020.	Native species richness	Yearly at peak growth in April	Increase	2020	In Area A, Southwest, total native species richness was 6 species. In Area C and D, the number of native species has remained below 5 (typically 1-2).	No; species richness less than metric as documented by J Luong.
Objective 3E. Increase cover of bare ground in the coastal prairie from baseline level to a level that enables SCT plants to complete their lifecycle by 2015.	Percent bare ground	3x during growing season	Increase	2015	In April, bare ground in Area A north was 7%; Area A Southwest was 17.2% and Area A Southeast was 5%. Bare ground in SCT-occupied areas in December 2024 was 3.8%	No, lack of grazing or other management that can create bare ground was lacking in 2024.
	Permanent photo points with GPS location and compass direction	Before, during and post construction and then yearly at peak growth	Improving	2015	Photo points established in April 2015, approximately 8 weeks after initiation of cattle grazing.	Photo points were taken in April 2024
Goal 4. Maintain a genetically and demographically viable soil seed bank in perpetuity.						
Objective 4A. Increase the density of viable ray achenes	Seed bank density (#of	Every 5 years	Increase	2015	No viable seed in Areas B and C; unlikely to have	Seedbank not reassessed; however, recruitment

Objective	Variable	Measurement Frequency	Desired Direction of Change	Interim Target Date	Year 11 (2024) Results	Objective Met?
in the soil seed bank from baseline in the first 3 years	viable ray achenes)				viable seed in Area D; viable seed in Area A and C from outplantings	from the multi-year SCT outplanting has occurred in Area A

5.6 Proposed Actions for 2025

The following actions and expected timing are proposed for 2025:

- Continue the cattle grazing program in Area A North, Area A Southwest and Areas C and D, beginning in January 2024, with grazing extending to June/July, depending upon presence of SCT flowers and forage. Consider implementing interim grassland management actions (i.e., focused mowing or other management) in winter if cattle grazing is delayed and canopy height levels are above the target objective of 2-3 inches (5-8 cm) between the months of November thru April. Evaluate need to mow in fall to reduce canopy height.
- Implement mowing in Area A Southeast and Area A Southwest concurrent with implementation of the 2025 SCT outplanting program. Periodically mow grassland to keep canopy height below 10 inches, with the goals of removing seed heads of non-native grasses.
- Monitor grazing operation and implement the HMP-designated BMPs (see Section 3.5.6 in HMP and bullet list above) (January– June/July).
- Mow delineated areas outside the grazing areas (May/June). Conduct pre-mowing surveys for breeding birds and locally unique flora.
- Continue to implement invasive plant species control as per the IWWP, focusing on removal/control of the following species:
    - Himalaya blackberry (*Rubus ameniacus)*
    - Cotoneaster *(Cotoneaster sp.)*
    - French broom (*Genista monspessulana)*
    - Velvet grass (*Holcus lanatus)*
    - Thistles (*Cirsium sp., Carduus sp., Silybum marianum)*
    - Medusa head (*Elymus caput-medusae)*
    - Stinkwort (*Dittrichia graveolens)*
- Consider using soil sampling test data evaluate soil deficiencies that may affect the growth of SCT and other native plant species.
- Review results of prior outplanting plots for SCT seed expression. Consider additional research to address questions on population maintenance and seedbank density.
- Conduct outplantings of SCT seedlings in February 2025, using plants grown at UCSC Greenhouses; outplant into Area A Southwest, Area A Southeast and Area C cattle exclosure.
- Consider continued outplanting of native grass plugs in Area A to increase native plant cover, pending availability of planting stock.
- Conduct census for SCT and monitor plant cover at occupied sites.
- Collect SCT seed if there are more than 50 plants; store seed for seed increase, storage, and possible out-planting, if needed.
- Monitor plant cover, canopy height, species richness, and bare ground at permanent transects and compare data to previous years and HMP desired direction of change (April/May).

- Document canopy height three times a year: February, April/May, and December.
- Document RDM in September/October.
- Document amount of bare ground in SCT occupied areas in December (SCT germination period).
- Evaluate and update, as needed, the draft sub-management area map and develop/finalize specific performance targets for percent cover of native species, nonnative species and bare ground, and species richness for coastal prairie that will be used to determine whether HMP objectives have been met, based on recent studies. In the absence of acceptable data on reference coastal prairies, the AMWG may use these three years of baseline data and a first year of monitoring data under grazing in April 2016 to begin refining the objectives under Goal 3.
- Document site conditions from the permanent photo-points.

6. Hagemann Gulch Riparian Woodland Management Area

Bridge and trail construction were completed in 2014 and erosion control and wildlife protection measures were implemented, consistent with Goal 3 of the HMP. Historic "Rose of Castille" bushes were relocated to City Hall in 2013, consistent with Goal 5 of the HMP. A riparian revegetation plan was prepared and approved by CDFW to compensate for impacts of the bridge project. Mapping and identification of invasive, non-native plant species was completed in 2017.

6.1 Management Actions

6.1.1 Integrated Pest Management (IPM)

The City did weed control (removal of Himalaya berry and English ivy) along the Marsh Vista Trail. Ivy was removed from several oak trees. The extent of invasive plant species was mapped in the management area in 2017.

6.1.2 Fire Hazard

In September 2023, the City Fire Department, through a State Coastal Conservancy Grant, implemented shaded fuel break management actions along The Prairie Loop Trail and other areas. Understory vegetation, as well as tree limbs, within an approximately 30-foot wide swath adjacent to the trail was cut and removed. Tree limbs were trimmed up to 8 feet in height. A treated area along the Prairie Loop Trail is depicted in **Figure 41.** All of the work areas are shown on **Figure 42.**

Figure 42. Area along Prairie Loop Trail Subject to Fire Hazard Reduction Work, 2023

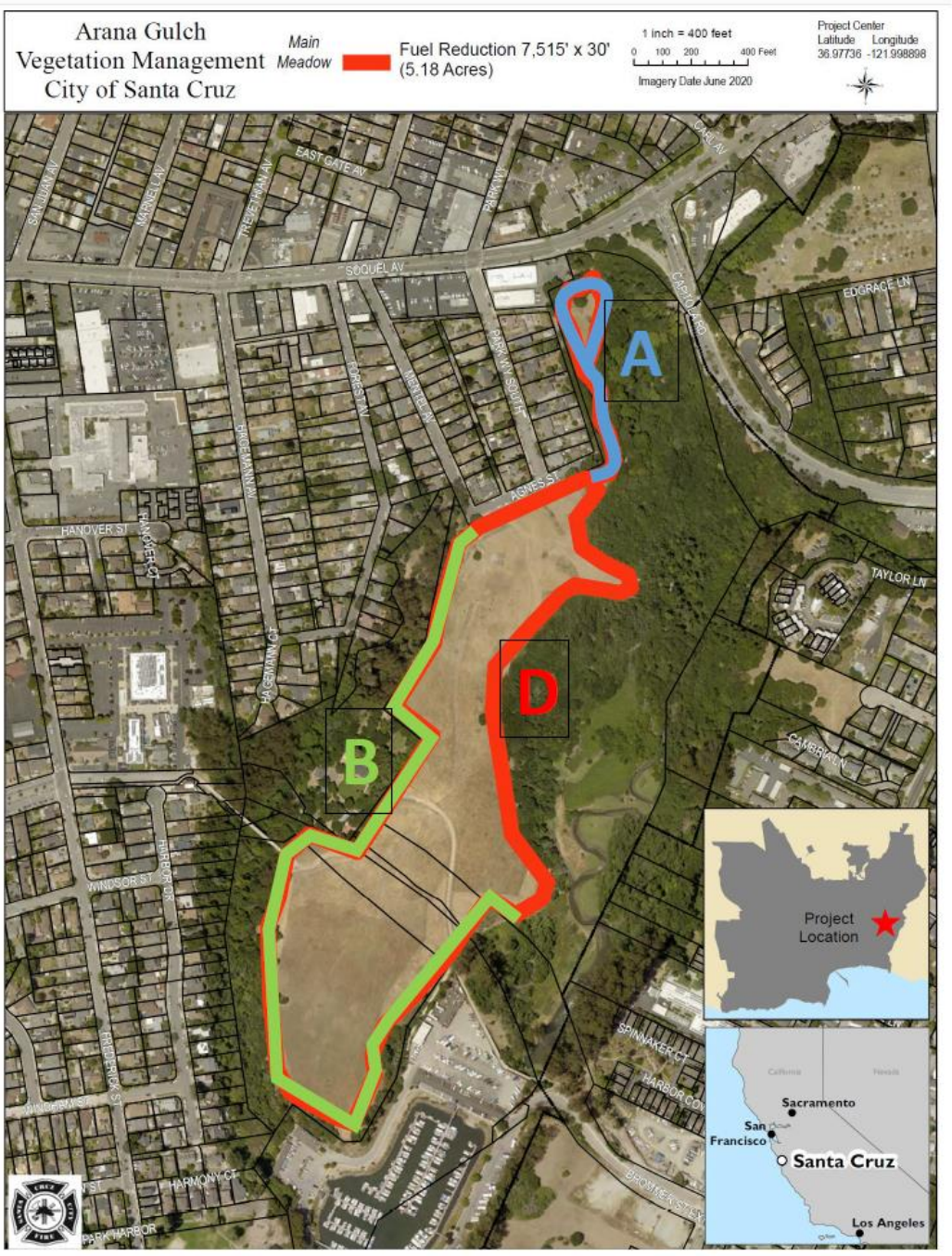


Figure 43. Vegetation Managment Areas for Fuel Reduction, 2023

No additional fire hazard abatement work was conducted in 2024.

6.1.3 Wildlife Protection

If necessary, prior to the implementation of vegetation management actions, surveys were conducted for nesting birds by qualified biologist. A pre-construction bird nest survey was conducted prior to the fuel management work described in 6.1.3, above; no active nests were detected in the work area.

6.1.4 Appropriate Uses

In 2024, the City monitored visitor use activities in this area. Police and City maintenance staff periodically patrolled open space activities in and around the gulch for transient encampments and other illegal activities. Encampments were removed as needed.

6.2 Monitoring and Performance Evaluation

6.2.1 Monitoring Methods and Results

Management actions were monitored in 2024. The monitoring was the documentation of invasive plant control/removal in the management area. Invasive plant occurrence maps were updated as the areas worked and existing occurrences.

6.2.2 Evaluation of HMP Goals

Table 9 presents a summary of the biological variables monitored, the Year 10 (2023) values, and the desired direction of change.

The HMP has a goal to seek funding to develop an integrated pest management (IPM) plan to reduce the understory of invasive non-native species in Hagemann Gulch (Goal 1, Objectives 1A, 1B, and 1C). Invasive plant species, primarily French broom, were removed from the fuel management work area along the Prairie View Trail, concurrent with the Fire Departments shaded fuel management work.

Goal 2 (Objective 2A) of the HMP for this management area identifies the need to reduce the fire hazard within the gulch. The objectives include reducing the cover of woody thickets (comprised of invasive, non-native species) and prioritize the removal of eucalyptus trees, as feasible. Construction of the multi-use bridge resulted in the removal of a several eucalyptus trees near the western abutment and from the central gulch; however, several large stands of eucalyptus trees remain. As noted above, the City began implementation of the IPM plan for the removal of the woody invasive plant species, consistent with this objective.

Figure 43 shows the infestations of invasive, non-native plant species mapped on site in 2017 and areas where removal/control efforts have been done since then.

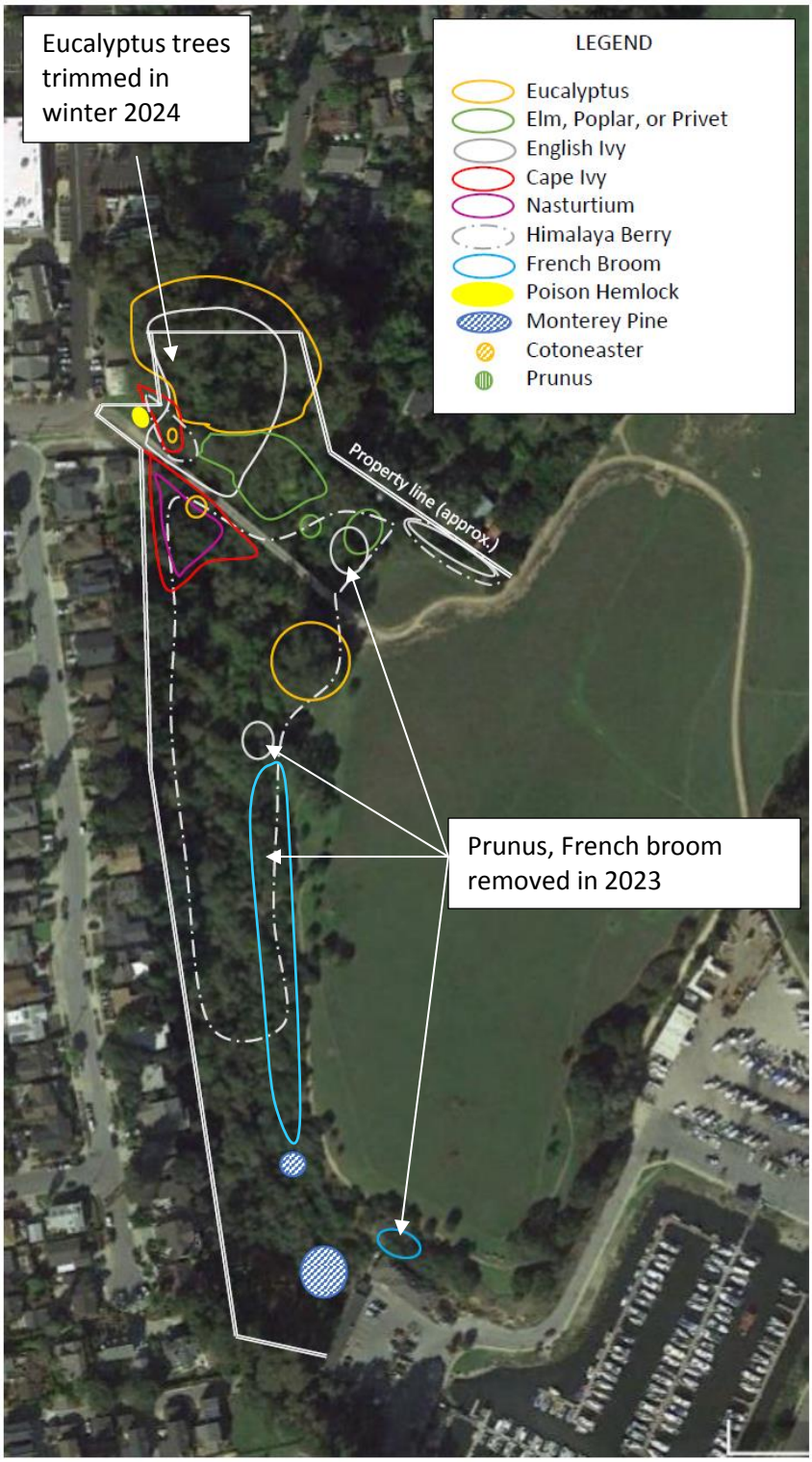


Figure 44. Invasive Plant Species Mapped in Hagemann Gulch Management Area in 2017and areas treated in subsequent years

Protection of wildlife habitat features is a goal of the HMP (Goal 3). This goal and it associated objectives were met concurrent with construction of the trail and the bridge over Hagemann Gulch in 2014. Objective 3A requires the identification and protection of San Francisco dusky-footed woodrats with the bridge construction zone (within 25m of the bridge). No woodrat nests/houses were documented within the construction zone. No further action is required; however, the City will continue to search for nests when work is performed in the area. Objective 3B requires monitoring for sensitive bird and bat roots and/or nests occurring within 25m of the Hagemann Gulch bridge, with monitoring and protection of such resources for 3-5 years post-construction. The 2013 bat survey found that the trees in the area provide only foliage roosting habitat. No cavities or crevices were found to support sensitive bat roosts. As the baseline is zero, no additional monitoring is required; however, the City could elect to monitor bat roosts to document if there is an increase in bat roosting after the trail and bridge project. Similarly, the 2014 nesting bird survey was negative for sensitive bird nesting. As the baseline is zero, no additional monitoring is required; however, the City could elect to monitor the area for sensitive bird nesting to document if there is an increase in such nesting after the trail and bridge project. These objectives are no longer applicable as part of the plan.

Goal 4 for this management area requires observing uses in Hagemann Gulch after trail and bridge construction and to determine if there are changes in use from site improvements. In 2023 police periodically patrolled the greenbelt to detect appropriate and inappropriate uses; off-leash dog use and periodic illegal encampments were noted in/around the bridge and other areas in/around the gulch. Objective 4A has been met.

Goal 5 of the HMP is to preserve the “Rose of Castille” bushes located near the Hagemann Gulch bridge construction area. To preserve these shrubs, the City elected to relocate them to City Hall in 2013, in consultation with the City Arborist. The shrubs are in excellent condition and Objectives 5A and B have been met.

6.3 Proposed Actions for 2025

The following actions and expected timing are proposed for 2025:

- Monitor appropriate uses within Hagemann Gulch through periodic police patrols (January– December).
- Continue to remove and control invasive, non-native plant species within the management area, as resources allow.
- Monitor encroachment of invasive, non-native plant species within the shaded fuel management work area and implement control measures as needed.

Table 9. Biological Variables Monitored in Hagemann Gulch Riparian Woodland Management Area

Objective	Variable	Measurement Frequency	Desired Direction of Change	Year 11 (2024) Results	Objective Met?
Goal 1. Seek funding to develop an integrated pest management (IPM) plan to reduce the understory of invasive non-native species in Hagemann Gulch					
Objective 1A. Use a combination of methods to reduce the cover of non-native invasive woody plant thickets from baseline levels in the first year.	Non-native invasive woody plant cover	Before and after every removal effort	Decrease	Eucalyptus trees removed near western bridge abutment and along bridge sightline	Partial compliance; some eucalyptus trees removed but some stands remain on City property; some trees trimmed in 2024
Objective 1B. Monitor re-sprouting of removed vegetation and recruitment of new seedling on a regular basis, for at least 5 years after initial removal efforts.	Re-sprout and seedling emergence of target weeds	After every removal effort	Decrease	Minor re-sprouting of eucalyptus branches from trees limbed for the bridge placement	Yes, re-sprouts were monitored; re-sprouts included in IPM plan that was developed in 2017
Objective 1C. If passive restoration is not adequately controlling erosion, use revegetation with appropriate native species or other cultural methods to limit the amount of exposed soil and the potential for re-infestation and erosion.	Area of exposed soil (bare ground)	After every removal effort	Decrease	No action; no erosion detected	Yes, no erosion has been detected; no actions needed at this time
Goal 2. Reduce the fire hazard within Hagemann Gulch					
Objective 2A. Reduce the cover of woody thickets as per Objective 1A to reduce overall fire risk.	Non-native invasive woody plant cover	Before and after every removal effort	Decrease	City Fire Department implemented a	Partial compliance; non-native thickets have been controlled within the

Objective	Variable	Measurement Frequency	Desired Direction of Change	Year 11 (2024) Results	Objective Met?
				shaded fuel management plan along Prairie Loop Trail	shaded fuel management area along Prairie Loop Trail in 2023
Objective 2B. Prioritize the removal of eucalyptus trees where feasible.	Area occupied by eucalyptus	After every removal effort	Decrease	Eucalyptus trees removed near western bridge abutment and along bridge sightline	Partial compliance; some eucalyptus trees removed but some stands remain on City property; trees trimmed in 2024.
Goal 3. Protect wildlife habitat features in Hagemann Gulch					
Objective 3A. The number of SF dusky-footed woodrat nests occurring within Hagemann Gulch bridge construction zone will be identified and the nests protected.	Number of SF dusky-footed woodrat nests within 25m of Hagemann Bridge construction zone	Yearly, if observed prior to construction.	Stable	None detected within construction area Hagemann Gulch bridge; unknown number within 25m of bridge	N/A. No nests were identified prior to construction
Objective 3B. Monitoring for sensitive bird and bat roosts and/or nests occurring within 25 m of the Hagemann Gulch bridge construction zone will be identified and protected and continued for 3-5 years post-construction.	Sensitive bird or bat detections within 25m of Hagemann Bridge construction zone	Yearly, if observed prior to construction.	Stable	None detected within 25m Hagemann Gulch bridge	N/A. No nests were identified prior to construction

Objective	Variable	Measurement Frequency	Desired Direction of Change	Year 11 (2024) Results	Objective Met?
Goal 4. Increase appropriate uses in Hagemann Gulch					
Objective 4A. Observe the condition of all improvements at least 4 times per year in the first 3 years and at least twice a year thereafter.	Observation of infrastructure conditions	4x per year	Stable	Stable	Park staff periodically inspected the area in 2024; issues of illegal encampments were documented in close proximity to the bridge
Goal 5. Preserve the "Rose of Castille" historic roses					
Objective 5A. Relocation of the roses will occur only if no other alternative is feasible for development of the Hagemann Gulch Bridge. Any relocation will be done in the vicinity of the existing trees, in consultation with the City Arborist.	Presence of Rose of Castile	Yearly in June/July	Stable	Shrubs relocated to City Hall	Yes, roses were located to City Hall to ensure regular maintenance and care
Objective 5B. Address the public education benefits of identifying the Rose of Castille and providing interpretative panels.	Presence of Rose of Castile	Yearly in June/July	Stable	Decision was made.	Staff determined that identifying them would expose them to potential theft and vandalism. No additional action is necessary.

7. Arana Gulch Creek Riparian Woodland and Wetland Management Area

The Arana Gulch Multi-Use Trail including the causeway over Arana Gulch Creek was completed in 2014. This construction project required the implementation of erosion control, wildlife protection measures prior to construction, and revegetation of areas near the causeway consistent with construction permit conditions. Riparian revegetation was implemented in 2015.

7.1 Management Actions

7.1.1 Trail and Causeway Construction Project

In 2014, the City prepared a riparian revegetation plan which was reviewed by the AMWG and approved by CDFW to compensate for impacts to native trees and shrubs by the causeway construction. Three areas were designated for revegetation. In 2014, Area A, the slope by the causeway, was hydroseeded with sterile seed as per the CDFW-approved revegetation plan. Twenty dormant willow cuttings were installed at the toe of the slope in December 2014. In Area B, located near the northwestern causeway abutment, 40 creeping wild rye (*Elymus triticoides)* were planted (March 2015). In Area C, a flat area north of the causeway, was planted with 40 creeping wild rye (*Elymus triticoides)*, 16 California rose (*Rosa californica)*, 16 mugwort (*Artemisia douglasiana)*, and 3 coast live oak (*Quercus agrifolia)* were planted (March 2015). The plantings were installed by City staff and volunteers recruited by the RDCSCC. The City maintained these plantings, implementing periodic weeding and hand-watering; however, plant survival of the willows in Area A was low and the area was replanted in winter 2016. Plant survival of the creeping wild rye was low in Area B; therefore, the City elected to install additional native shrubs in Area C, where growing conditions were considered to be better. Roses for the Hagemann Gulch Bridge project were also planted in this area. Additional willow pole cuttings (25) were installed along the slope above Arana Creek to replace previous plantings that died.

7.1.2 Wildlife Protection

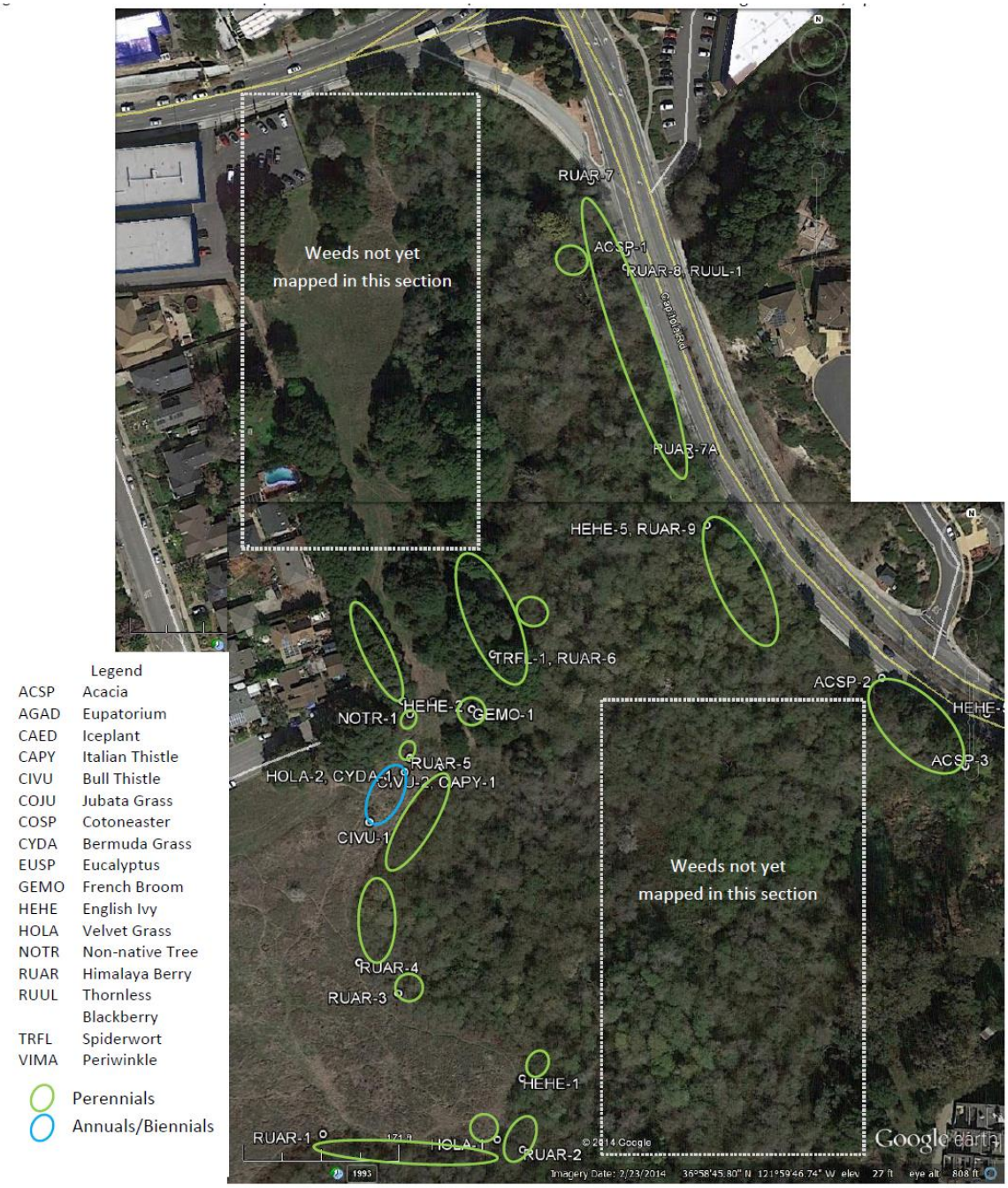
Prior to construction of the Arana Gulch Multi-Use Trail, measures were implemented to avoid impacts to wildlife. These measures were completed in 2014. No additional management actions were implemented in 2024.

7.1.3 Integrated Pest Management (IPM)

In 2014 and 2015, mapping of invasive weeds within this management area was initiated. The mapping is to guide future management activities for species removal/ control. The approximate size, density of plants (dense, moderate, and sparse) and the location of each non-native invasive species patch was documented using GPS and mapped on aerial photos. A map of data collected, including updates in 2019 and work completed since then, is presented in **Figure 44A-D**.

Invasive non-native plant species documented to date in the management area include: (*Acacia spp.)*, perennial pepperweed (*Lepidium latifolium*), eupatorium (*Ageratina adenophora)*, ice plant (*Carpobrotus edulis)*, Italian thistle (*Carduus pycnocephalus)*, bull thistle (*Cirsium vulgare)*, jubata grass (*Cortederia jubata)*, cotoneaster (*Cotoneaster sp.*), Bermuda grass (*Cynodon dactylon*), eucalyptus (*Eucalyptus sp.)*, French broom(*Genista monspessulana*), English ivy (*Hedera helix*), velvet grass (*Holcus lanatus*), Himalayan blackberry (*Rubus ameniacus*), thornless blackberry (*Rubus ulmifolius)*, spiderwort (*Tradescantia fluminensis)*, and periwinkle (*Vinca major)*.

In 2024, the City continued closure of the ad-hoc path along Arana Creek to discourage public access to the natural area. Clean-ups from illegal camping activities were performed to remove trash and waste, primarily from the woodland areas. In some instances, vegetation was removed to improve the line-of-sight from the public right-of-way into the area, deterring illegal activity and improving law enforcement patrolling and monitoring. Extensive trash and waste removal occurred near the intersection of Capitola Road and Soquel Drive. Unfortunately, the activities necessitated more staff time and resources to be diverted to daily trash and waste removal.



Arana Gulch Greenbelt – Location of Invasive Plant Species in Arana Creek Management Area
April, 2015 - Sheet 1 of 4

Figure 45A. Location of Invasive Plant Species within Arana Gulch Creek Riparian Woodland and Wetland Management Area and Recent Work Areas

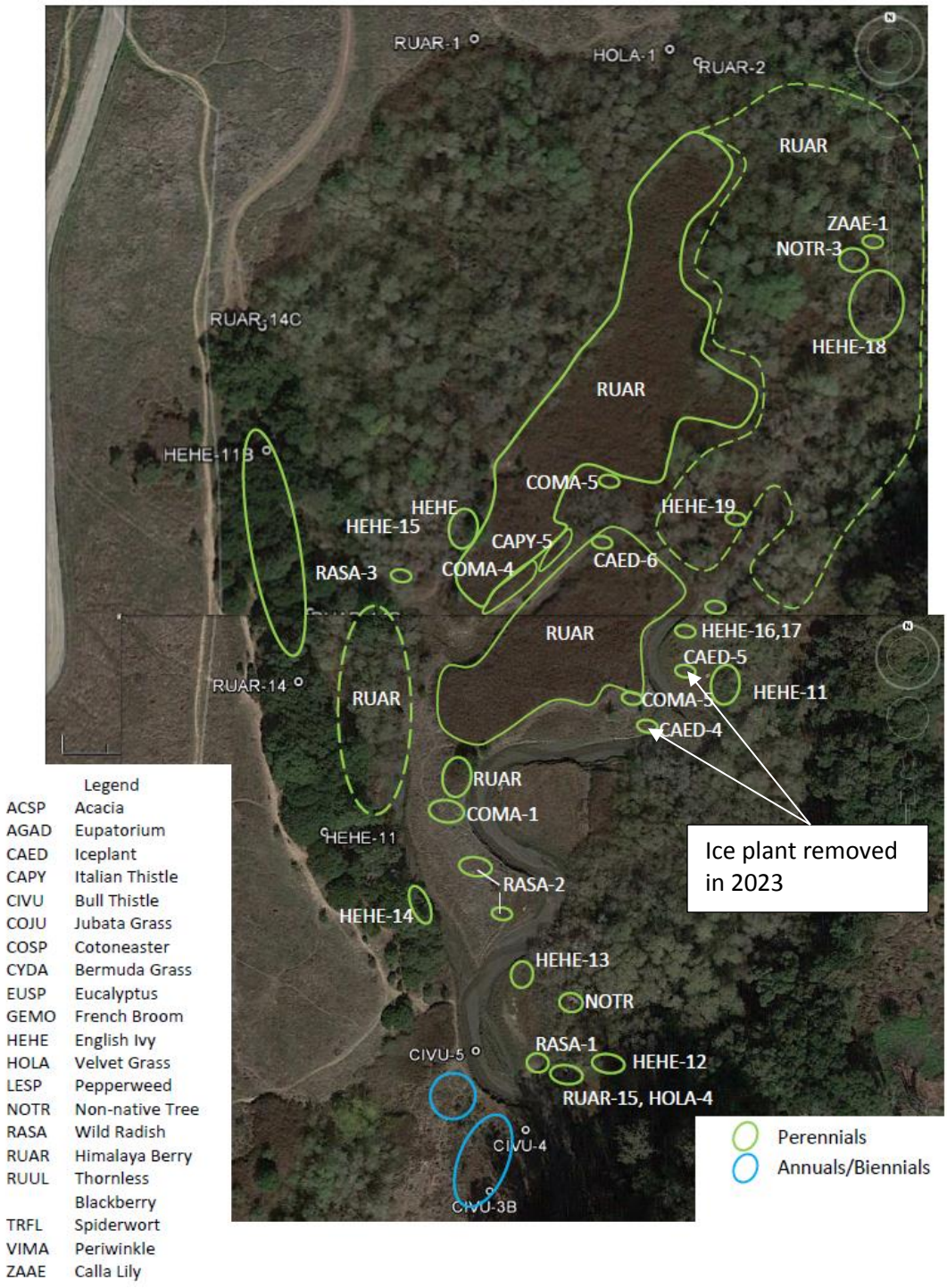


Figure 44B. Location of Invasive Plant Species within Arana Gulch Creek Riparian Woodland and Wetland Management Area and Recent Work Areas

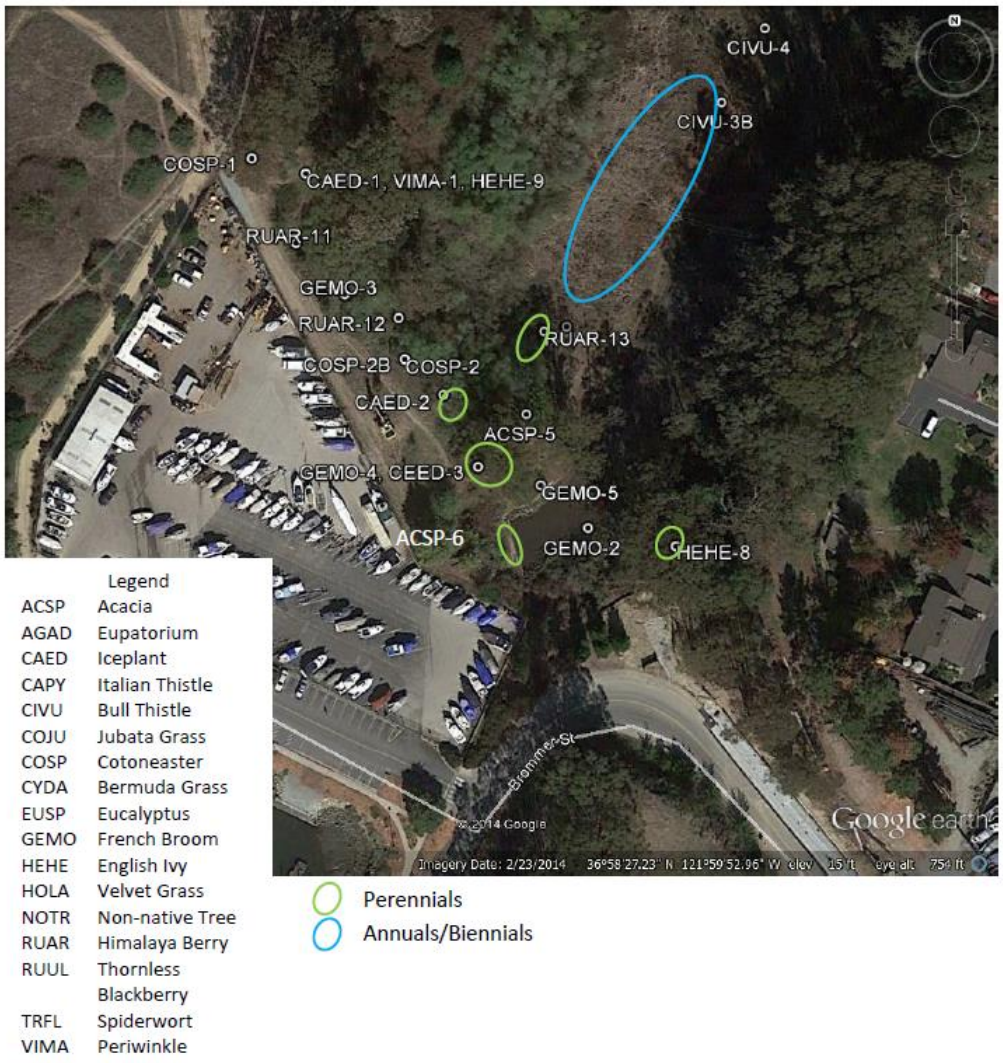


Figure 44C. Location of invasive plant species within Arana Gulch Creek Riparian Woodland and Wetland Management Area and Recent Work Areas

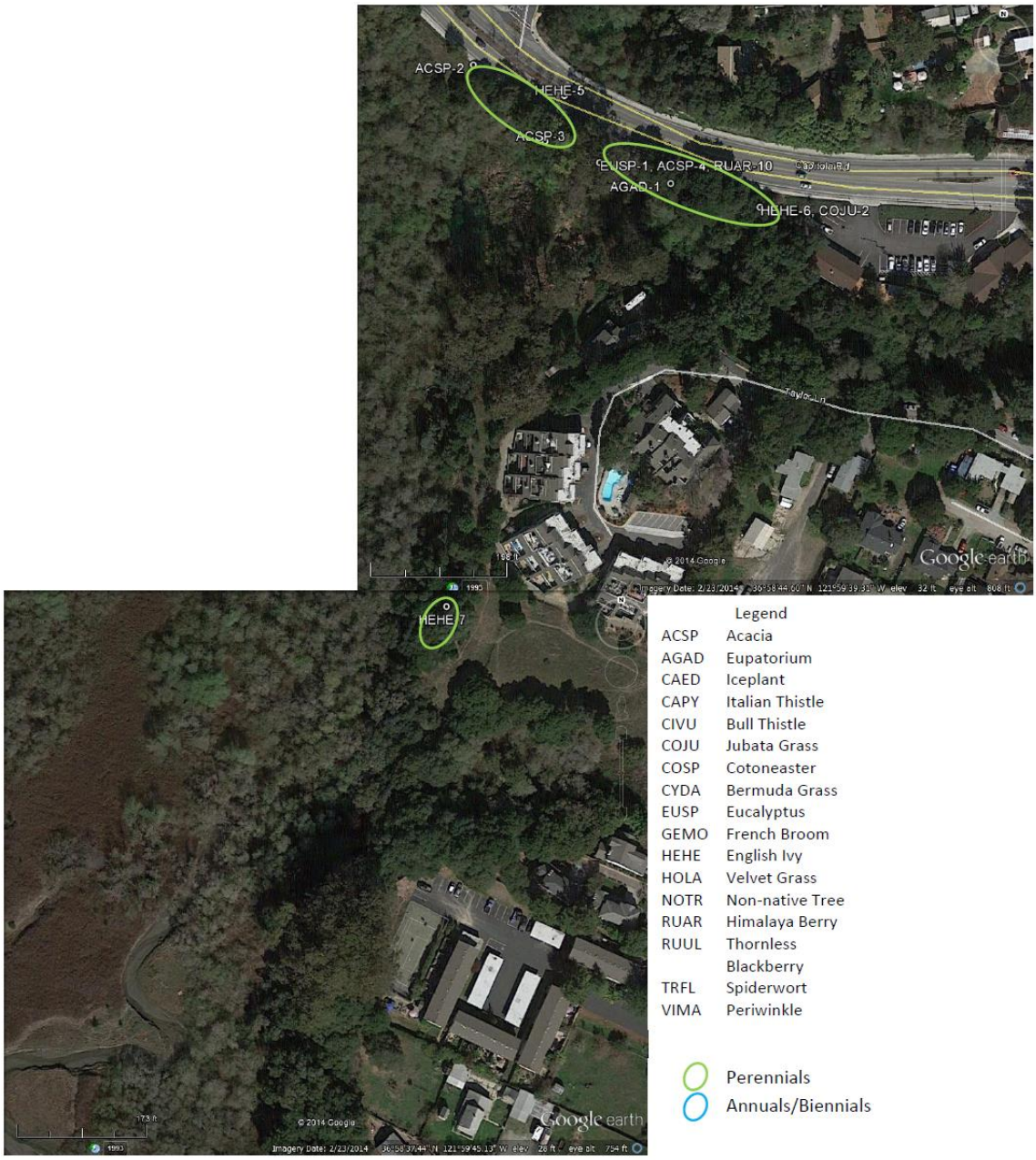


Figure 44D. Location of invasive plant species within Arana Gulch Creek Riparian Woodland and Wetland Management Area and Recent Work Areas

7.1.4 Coordination with the RCDSCC

No actions between the City and the RCDSCC were conducted in 2024.

7.2 Monitoring and Performance Evaluation

7.2.1 Monitoring Methods

No monitoring was performed in 2024. Monitoring of the riparian revegetation areas was completed in 2020 (5-years).

7.2.2 Monitoring Results

None.

7.2.3 Evaluation of HMP Goals

Table 10 presents a summary of the biological variables monitored, the Year 11 (2024) values, and the desired direction of change.

The HMP has a goal to seek funding to reduce sediment and improve steelhead conditions within the Arana Gulch watershed (Goal 1 of HMP), a goal to stabilize the tidal reach of Arana Gulch Creek (Goal 2), and to restore the eroded gully on the greenbelt (Goal 3). To meet this goal, the City has conferred with the RCDSCC in previous years to discuss management activities within the watershed and within the greenbelt property. There was no active coordination in 2021.

Goal 4 is to develop an integrated pest management (IPM) plan to reduce the understory of invasive non-native species in the management area (Goal 4). The City continued to make progress on this task by removing occurrences of invasive, non-native plant species growing within the management area in compliance with goals of the HMP.

7.3 Proposed Actions for 2025

The following actions and expected timing are proposed for 2025:

- Be available to engage with the RCDSCC on their watershed and greenbelt projects, as proposed by the RCDSCC. (January– December 2024).
- Continue to remove and control occurrences of invasive, non-native plant species within the management area, as resources allow and develop a monitoring program to document progress of management actions.

Table 10. Biological Variables Monitored in Arana Gulch Creek Riparian Woodland and Wetland Management Area

Objective	Variable	Measurement Frequency	Desired Direction of Change	Year 11 (20243) Results	Objective Met?
Goal 1. Reduce sedimentation and improve steelhead habitat conditions within the Arana Creek watershed					
Objective 1A. High priority sediment-related projects identified in the Arana Creek watershed enhancement plan area implemented.	# of completed sediment-related projects with the RCDSCC	Yearly	Increase	No action.	No
Objective 1B. High priority steelhead habitat improvements identified in the Arana Creek watershed enhancement plan area implemented.	# of completed steelhead habitat improvement projects with the RCDSCC	Yearly	Increase	No action.	No
Goal 2. Stabilize the tidal reach of Arana Gulch Creek					
Objective 2A. Engage the RCDSCC Arana Gulch Working Group staff to attend targeted AMWG meetings to identify possible solutions for the tidal reach of Arana Gulch Creek.	RCDSCC attendance at AMWG meetings	Yearly	Increase	No action.	Yes. City will continue to coordinate with RCDSCC to meet goals, as projects are proposed
Objective 2B. Work with the RCDSCC staff to obtain funding to design and implement a bank restoration project that reduced head cutting and bank erosion	Funding level for the tidal reach restoration	Yearly	Obtain/increase	No action.	No

Objective	Variable	Measurement Frequency	Desired Direction of Change	Year 11 (20243) Results	Objective Met?
along the tidal reach of Arana Gulch Creek.					
Goal 3. Restore the eroded Greenbelt Gully					
Objective 3A. Work with the RCDSCC staff to pursue funding for the Greenbelt Gully restoration project.	Funding level for the Greenbelt Gully project	Yearly	Obtain/increase	No action.	No
Goal 4. Seek funding to develop an integrated pest management (IPM) plan to reduce the understory of non-native species in the Arana Gulch Creek Management Area					
Objective 4A. Remove and reduce the cover of non-native invasive species in the riparian woodland relative to baseline conditions including: black acacia found near the culverts, dense thickets of Himalayan berry, scattered French broom, tall white top, and periwinkle.	Non-native invasive woody plant cover	Yearly	Decrease	Himalaya berry removed from near the Marsh Vista Trail; ice plant removed from marsh plain of Arana Creek	Partial, invasive, non-native plant species continue to be removed and controlled
Goal 5. Provide education opportunities and increase appropriate uses					
Objective 5A. Observe the condition of all improvements at least 4 times per year in the first 3 years and at least twice a year thereafter.	Observation of infrastructure conditions	4x per year	Stable	Conditions were monitored.	First year of monitoring was 2015

8. Conclusions from Year 11 and Recommendations for Year 12 (2025)

8.1 Conclusions from 2024

The City continued implementation of the HMP in 2024 (Year 11). Actions were conducted in all of the management areas. Cattle were grazed in the grassland in Area A North, and Areas C and D for SCT and overall grassland management. Area A Southwest and Southeast were mowed for grassland/prairie management. A 4th year of SCT outplantings was implemented, with 1,118 SCT plants installed in Area A Southeast and Area C (cattle exclosure). The 705 surviving SCT outplantings in Areas A Southeast produced over 21,000 flowerheads with their seeds released into the soil seedbank. The 302 surviving SCT outplantings in Areas C produced over 9,000 flowerheads with their seeds released into the soil seedbank. In addition, seed deposited from the 2021-2023 outplantings produced 3,134 SCT plants, with over 15,000 flowerheads, with their seed released into the soil seedbank. There was effective and efficient coordination between the City and the AMWG in 2024 as management actions and monitoring protocols were discussed. The City communicated with users of the greenbelt on the cattle-grazing and provided police patrols to encourage/enforce regulations and deter vandalism and illegal camping.

8.1.1. Coastal Prairie/Santa Cruz Tarplant Management Area

Within the Coastal Prairie/SCT Management Area cattle grazing occurred at varying duration and intensity in Area A North, Area A Southwest, and Areas C and D all year. Implementing cattle grazing is in compliance with the HMP. Area A Southwest was grazed briefly in January and February. Grazing was successful in maintaining the desired February canopy height in these areas. Periodic mowing was used in Area A Southwest and Southeast for SCT and grassland management; the mowing was compatible with the SCT outplanting actions and seed dispersal objectives; however, it did not control thatch buildup. Monitoring of plant cover and residual dry matter was implemented and some objectives were met in some areas for these variables. Objectives of the HMP relating to improving the coastal prairie to a more functioning system have been met in Area A Southwest, but not in other areas. The addition of more monitoring transects in Area A South in 2023 was successful in capturing the coastal prairie plant composition and distribution in this area. Grassland management actions were also implemented outside of the Areas A, C, and D grazing areas. Mowing of the perimeter grasslands was conducted in May and June. Management of these grassland areas is required under the HMP; therefore, the City is in compliance with the HMP.

A census of SCT was conducted in 2024. A total of 4,141 SCT plants were documented in Area A Southwest, Area A Southeast, and Area C (cattle exclosure). The HMP objective of reaching 348 plants was met in 2024.

8.1.2. Hagemann Gulch Riparian Woodland and Arana Gulch Creek Riparian Woodland and Wetland Management Areas

Management actions were conducted in the Arana Creek Riparian Woodland and Wetland Management Area and the Hagemann Gulch Riparian Woodland Management Area in 2024, by way of police patrols, City staff actions to monitor visitor uses, and City crew and volunteer actions to remove invasive, non-native plant species. Some eucalyptus trees near the Hagemann Gulch bridge were trimmed in 2024.

8.1.3. Adaptive Management and Public Outreach

The City engaged with the AMWG in 2024 through field and web-based meetings in two meetings (May and September) as well as via email correspondence. The City received input from the AMWG on management actions and implemented the requested management actions. The City maintained a web page on the City's website for public outreach and responded to comments from the public and the AMWG on ways the site could be improved. These actions were in compliance with the HMP.

8.1.4 Schedule and Budgeting

The City established a line item in their operating budget for Arana Gulch and allocated funds for fiscal year July 1, 2023 to June 30, 2023 and fiscal year July 1, 2024 to June 30, 2025. The City established a maintenance position for the greenbelt, which became effective in January 2016. Establishing funding for management actions is in compliance with the HMP.

8.2 Recommendations for 2025

The City will discuss with the AMWG recommendations for management actions for 2025 at a minimum of two meetings in 2025. These meetings may be field and/or virtual (web-based) meetings. The AMWG will provide input to the City on actions based on management priorities. The following summary of actions is preliminary and may be revised based on input from the AMWG and available funding.

8.2.1 Coastal Prairie/Santa Cruz Tarplant Management Area

HMP activities for 2025 (Year 12) is the continuation of seasonal cattle grazing within portions of the prairie/grassland. The City will continue to implement the Stocking and Work Program in Area A North, Area A Southwest and Areas C and D. Cattle will be used for prairie and SCT management purposes in Area A Southwest and the cattle exclosure in Area C. Periodic grassland mowing will occur in both Area A Southwest and Southeast, concurrent with implementation of the SCT outplanting actions. Management activities will include monitoring plant composition, plant cover and residual dry matter (RDM) within the grazed areas, grassland conditions along the permanent transects, documenting conditions from the permanent photo-stations, and continuing to remove and control high-priority invasive, non-native plant species. The City will consider implementing additional management actions if cattle grazing is delayed and canopy height exceeds the height limits established for the period November through April.

The City will also continue to implement seasonal mowing outside the grazing fences that are to be retained as grassland. A census of the SCT will be conducted in summer/early fall 2025. Naturally-occurring colonies, as well as survival of the 2025 SCT outplanting plots, will be censused. Seed collection of SCT may occur depending on the SCT population and prior approval from CDFW. Plants grown at UCSC Greenhouses are scheduled to be installed within management areas in February 2025. The City will consider implementing additional management actions to encourage SCT seed expression.

As stated in Chapter 5, the early stages of SCT recovery have been successful; however, many habitat management questions remain. The next stage of species recovery needs to determine the management that can maintain and/or increase both the SCT population and its areal extent into the future. There are questions on optimum SCT seedbank density and viability, optimum grassland management techniques, as well as the need for long-term seed collection, plant propagation, outplanting, and direct seeding.

Population Maintenance Seedbank Density

- What is required seedbank density for long-term preservation of SCT on site; how often should SCT outplanting occur to reach desired seedbank density?
- How much seed production is needed each year to maintain desired seedbank density?

Grassland Management for SCT

- Effect of mowing/grazing on SCT population, including how many above-ground SCT plants are needed to maintain (or increase) SCT population, taking into account herbivory and/or plant/seed losses
- Amount of bare ground needed in winter for SCT seed germination
- Optimum cropping height for SCT to increase branching and subsequent flower and seed production
- Evaluate vectors for seed dispersal and SCT establishing outside of planted plots.

8.2.2 Hagemann Gulch Riparian Woodland Management Area

HMP activities identified for 2025 (Year 12) will be to monitor appropriate uses within the gulch concurrent with public use of the trail and bridge. City police will monitor use as per their regular patrol duties within the greenbelt. Invasive plant control measures will be continued, pending funding and staffing.

8.2.3 Arana Gulch Creek Riparian Woodland and Wetland Management Area

HMP activities identified for 2025 (Year 12) will be continued removal and control of invasive, non-native plant species.

8.2.4 AMWG and Public Outreach

In 2025 the City will continue to confer with the AMWG on adaptive habitat management activities throughout the year through scheduled meetings and group email correspondence. The AMWG will provide recommendations to the City on management priorities, grazing monitoring and public outreach. The City will solicit input from the public on HMP actions through the City webpage and through public input at the scheduled AMWG meetings.

8.2.5 Schedule and Budgeting

Table 11 presents a schedule for the HMP actions scheduled for 2025. The City has allocated funds for fiscal year July 1, 2024 to June 30, 2025 and funding for fiscal year July 1, 2025 to June 30, 2026.

Table 11. Timeline for Habitat Management Actions Proposed for Year 12 (2025)

	2025												2026
Task	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
Coastal Prairie/Santa Cruz Tarplant Management													
Objective1. Santa Cruz tarplant census, measure plant cover and soil moisture; document bare ground (Nov/Dec); outplantings of grown SCT; seed collection.													
Objective 2. Monitor grazing program and variables; implement other grassland management actions (mowing), as needed to control grass height.	✶												
Objective 3. Monitor baseline condition and photo points													
Hagemann Gulch Riparian Woodland Management													
Objectives 1 and 2. Implement IPM Plan and reduce fire hazard													
Arana Gulch Creek Riparian Woodland and Wetland Management													
Objectives 1, 2, and 3. Collaborate with RCDSCC													
Objective 4. Implement removal/control of invasive													

	2025												2026
Task	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**
non-native woody plant species and target weeds													
Objective 5. Infrastructure monitoring[10]													
Adaptive Management													
Objective 1. Conduct AMWG meetings													
Prepare Yearly Monitoring Report													
✶ Initiate grassland management actions if cattle grazing does not meet canopy height targets between November and April													

[10] Includes riparian revegetation and implementing year-long maintenance and monitoring.

9. References

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Appendix A AMWG Meeting Minutes, 2024

NOTE: Please see the separate Appendix document

A-1: AMWG Meeting Minutes for:

May 3, 2024
September 11, 2024

Appendix B Photo Monitoring

NOTE: Please see the separate Appendix document