Ballona Wetlands Restoration: Community Iceplant Removal Project

Year 6 Annual Report

October 2022

Prepared for the California Coastal Commission, California Department of Fish and Wildlife, National Fish and Wildlife Foundation, and California State Coastal Conservancy

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Annual Report (Year 6)

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Coastal Development Permit No. 5-15-1427

Prepared by: The Bay Foundation

Prepared for:

California Coastal Commission
California Department of Fish and Wildlife
National Fish and Wildlife Foundation
California State Coastal Conservancy

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Acknowledgements

We would like to thank the Southern California Wetlands Recovery Project for funding the first phase of this project through the Community Wetland Restoration Grant Program (Grant #2015-001) and the National Fish and Wildlife Foundation and California State Coastal Conservancy for additional funding. We are grateful for the help of the many volunteers who participated in this restoration project and appreciate all of their efforts and donated time. We also want to acknowledge and thank our partners: California Department of Fish and Wildlife, Friends of Ballona Wetlands, Loyola Marymount University Coastal Research Institute, and Los Angeles Conservation Corps. Additionally, we are especially grateful to the staff of E. Read and Associates for contributing so much of their time to help the project succeed. We would also like to recognize and acknowledge that we are on the land of the Gabrielino-Tongva people who have lived and continue to live here. We pay respects to their elders past and present, and thank them for their strength, perseverance, and resilience. We also thank the Tribe for their substantial participation and input on this project; the project team appreciated their recommendations for culturally appropriate native vegetation in the planting plan and to minimize disturbance in restoration techniques. We appreciate everyone's long-term commitments and assistance from everyone involved.

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Report Summary

The Bay Foundation (TBF), in partnership with California Department of Fish and Wildlife (CDFW), Friends of Ballona Wetlands (FBW), and community volunteers are conducting a project to remove invasive vegetation while broadening public involvement and stewardship at the Ballona Wetlands Ecological Reserve (Reserve). This report serves as the sixth annual report of the "Ballona Wetlands Restoration: Community Iceplant Removal Project" prepared for the California Coastal Commission to meet the annual reporting requirements for Coastal Development Permit No. 5-15-1427. This report summarizes restoration activities and monitoring results from 1 September 2016 through 31 July 2022.

The project focused on the removal of *Carpobrotus spp*., or iceplant, from a targeted area within Area B of the Reserve and maintaining the area to benefit native vegetation. Removing iceplant and other non-native vegetation on site will help protect the remaining native flora that will be critical to the revegetation of the Reserve for the larger multi-year restoration effort. Iceplant is a creeping, mat-forming group of species that form dense monocultures, causing a reduction in biodiversity and competing directly with native wetland species. Its removal and the continued maintenance of the site through the removal of other invasive vegetation species will provide an increase in the health and condition of the wetland habitats at the Reserve in Area B – south of Culver Boulevard and has allowed for community engagement in hands-on restoration efforts. Pre- and post-restoration monitoring will evaluate the progress of the project over time and will provide recommendations for additional community-level restoration opportunities on-site and at other, similarly impacted urban wetland systems throughout Southern California.

Two iceplant removal methods were implemented by project participants. The first method involved traditional hand-restoration through pulling out iceplant mats by the roots, shaking them to remove dirt and debris, and removing them from the site to be green-waste processed or composted. The second method involved covering iceplant monocultures with large black plastic tarps to eliminate radiant sunlight and leaving the desiccated iceplant in place as mulch. Tarping was only conducted during the first summer of Year 1 and all subsequent invasive plant removal activities have utilized hand removal techniques, clipping of seed heads, or weed whacking.

Over the course of six implementation years, an estimated total of over 51.66 tons of iceplant were removed from site, with removal of many other non-native invasive plants species. Successful removal of iceplant and other non-native vegetation continued through Year 6. In Year 6, an estimated 16.66 tons of icpelant were hand-pulled along with removal of other non-native vegetation. The restoration footprint expanded an additional 0.52 acres during Year 6, with a total project restoration footprint of 2.23 acres across all years.

Restoration and site maintenance activities were performed by TBF, project partners, and volunteers. Volunteers contributed significantly to the restoration efforts. For all years combined, 606 volunteers contributed 1,516 hours across 53 community restoration events. However, no public restoration events were held in Year 5, due to the spread of the novel coronavirus and subsequent restrictions by Los Angeles County Department of Public Health. Restoration events resumed in Year 6, with COVID safety measures in place, and consisted of 149 volunteers contributing 298 hours across 12 restoration events.

Six additional targeted non-public restoration and site maintenance events were held in Year 6. TBF staff, project partners, and interns focused on removing non-native vegetation such as radish (*Raphanus sativus*), prickly lettuce (*Lactuca serriola*), iceplant, and Geraldton carnation weed (*Euphorbia terracina*).

In Year 6, there was significant restoration progress following the challenges faced in Years 4 and 5. COVID posed a significant challenge in Year 5, as restoration events were halted due to local public health restrictions. Public health restrictions and the lack of volunteers hindered restoration and maintenance activities and slowed project progress. In addition, challenges in Years 4 and 5 included a series of illegal vehicle incursions on-site, which repeatedly impacted the restoration project area and progress, and the dumping of sediment and construction debris on the hillside area of the restoration project. Year 6 showed positive development in the area previously impacted by illegal vehicle incursions and sediment dumping. Following removal of the illegal vehicles and dumped sediment, there were substantial efforts to reseed and plant native container stock vegetation in Year 5. In Year 6, there was successful establishment and growth of native species that were planted and seeded in the previous reporting year. In many areas, there was increased native species richness and native plant cover, particularly on the hillside area that was previously impacted by illegal vehicle incursions and sediment dumping. In addition, resumption of volunteer-based restoration events bolstered restoration efforts and maintenance activities to remove non-native iceplant and weedy non-native annuals.

Implementation of activities in the time of COVID-19 required extensive preparation to prioritize human health, reduce safety risks, and follow regulatory restrictions. This included cancelling or postponing all on-site activities, including TBF maintenance events, from 20 March through 21 April 2020 in accordance with state and local guidance by the Center for Disease Control and Prevention and LA County Department of Public Health (LACDPH). During this time, TBF and partners coordinated to adapt to challenges by drafting safety guidelines to follow in the field, such as social distancing and face coverings; however, not being allowed in the field during an important weed removal time added challenges. When activities resumed, on 22 April 2020, they were limited to staff and interns only, which continued through the end of Year 5. Volunteer activities were suspended March 2020 through July 2021 and resumed in August 2021 in accordance with permit guidelines and agency recommendations for public events and activities. Additional details can be found in the “Challenges” chapter.

Long-term restoration of the project site will likely require a continued period of ongoing maintenance and adaptive management efforts to remove non-native, invasive vegetation. In Year 6, there was a continued need for maintenance of non-native vegetation. Weedy non-native annuals continued to be a challenge and were intermixed with native shrubs and herbs. In particular, areas lacking some mixed native cover in the baseline conditions and along the roadside required attention for removal of non-native annual species. Non-native annuals will require continued maintenance into Year 7.

On 1 August 2022, the public permit conditions of CDP No. 5-15-1427 will begin again, and TBF plans on continuing public community events. The scheduling of future events will be informed by and in accordance with public health agencies, such as the Center for Disease Control and Prevention, and by local authorities, such as LACDPH. Updates on the status of future events may be found on TBF’s website, www.santamonicabay.org, click on “events”.

Figure 1. Restoration activities being conducted by volunteers on 13 October 2021 (top) and 30 October 2021 (bottom).

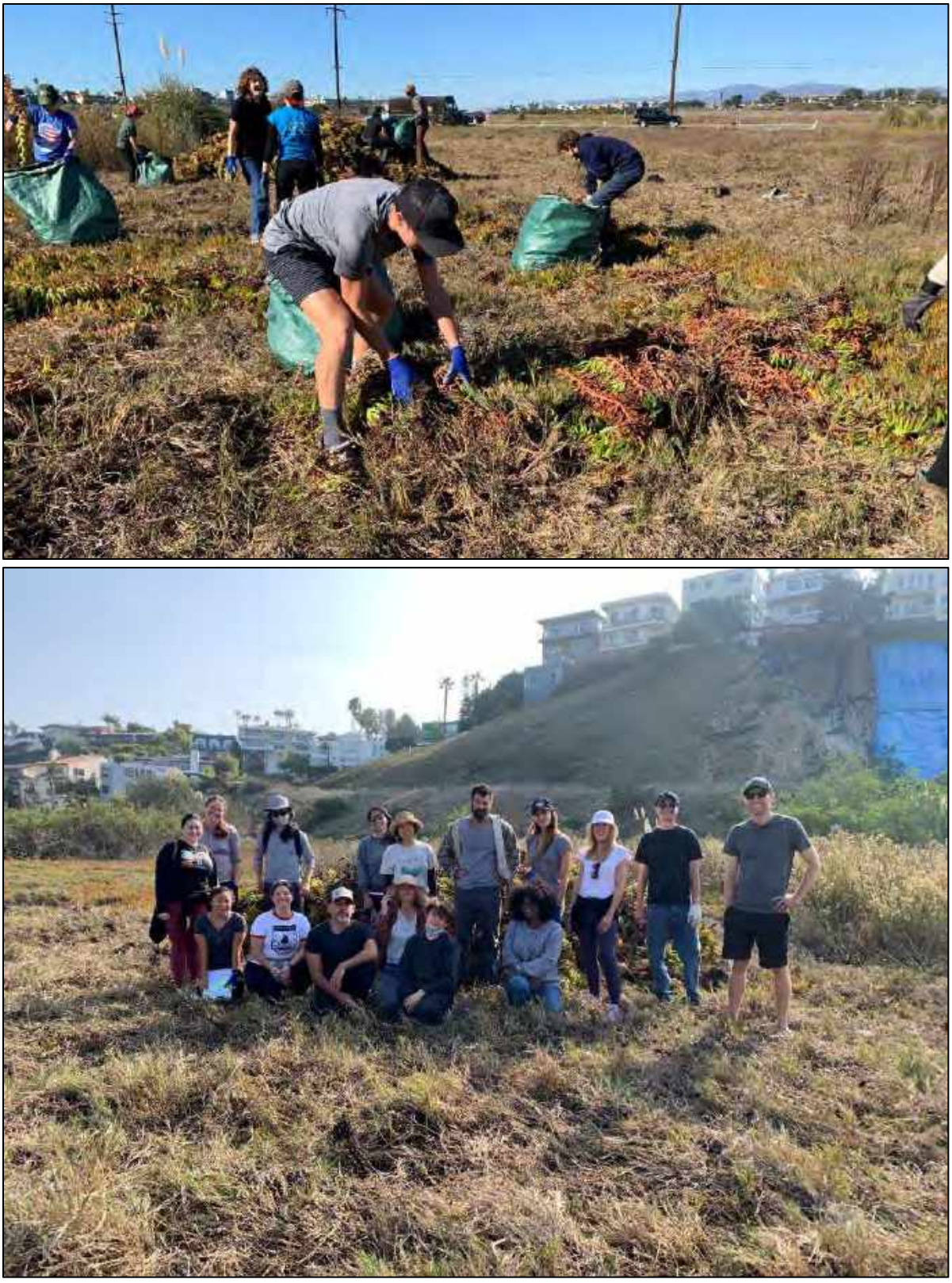


Figure 2. Restoration activities being conducted by staff and volunteers on 11 December 2021 (top) and 4 December 2021 (bottom).

Restoration Activities

Restoration events for this project began on 1 September 2016, in accordance with Coastal Commission permit conditions (CDP No. 5-15-1427). Desiccating iceplant through solarization required installing tarps over iceplant monocultures during the hot summer and early fall months; therefore, TBF prioritized installing tarps as part of initial restoration efforts in 2016. Two events per day were held during the first three restoration days to maximize tarp deployment time. All tarps were fully deployed by 8 September 2016. Additional restoration events focused on hand-removal of iceplant. Tables 1 and 2 provide summary details of all restoration activities from 1 September 2019 through 31 July 2022. Table 1 includes statistics on the number of volunteers, number of hours, restoration activities, and site details for all community restoration events, whereas Table 2 displays restoration activity dates with TBF staff, project partners, and interns only.

Over the duration of Year 1, over 15 tons of iceplant (more than 200 cubic yards) were removed from the restoration area to a green waste dumpster for composting. Weight was calculated by the dumpster rental company before processing the invasive vegetation waste and cubic yard area was estimated by the total dumpster space used. During Year 2, 39 large tarps and 15 trash bags of non-native, invasive vegetation were removed from the same restoration area as Year 1 activities. Only small-scale hand restoration maintenance activities were conducted during Year 2, so the total weight removed and effort reflects that focus. During Year 3, an estimated nine tons of iceplant were hand-pulled during restoration events. An additional 119 bags (72-gallon bags) of other non-native and invasive vegetation, such as radish, mustard (*Brassica* spp.), and castor bean (*Ricinus communis*), were also removed. During Year 4, nearly eight and a half tons of iceplant were removed during community restoration events. An additional 33 bags (72-gallon bags) of other non-natives, such as mustard, radish, castor bean, and Geraldton carnation weed were also removed during Year 4. During Year 5, an estimated 2.5 tons of iceplant were hand-pulled during restoration days. An additional 233 bags (72-gallon bags) of other non-native and invasive vegetation, such as radish, mustard, crown daisy, and Geraldton carnation weed, were also removed. During Year 6, an estimated 16.66 tons of iceplant were hand-pulled and an additional 79 bags (72-gallon bags) of other non-native and invasive vegetation were removed during restoration days. Estimations for Years 3-6 were calculated by multiplying the total number of bags removed by the average weight of 10 full bags. Over the course of six implementation years, an estimated total of over 51.66 tons of iceplant have been removed from site. Figures 3-4 are photographs of restoration activities.

Exact total acreages of both the hand-restored and tarped restoration areas were calculated using a Trimble Geo7x GPS and mapped using GIS (Figure 5). Initial restoration efforts in Year 1 included hand restoration in an area of 0.39 acres (1,585 m^2), and tarped restoration area in an area of 0.36 acres (1,460 m^2) for a total project footprint of 0.75 acres. During Year 2, the restoration area of 0.75 acres was maintained, primarily removing invasive annual weeds. During Years 1 and 2, hand restoration efforts occurred as part of ongoing site maintenance throughout the restoration footprint. In Year 3, project expansion began by strategically targeting buffer perimeters to the Year 1 and 2 restoration footprint and then expanding to remove iceplant by hand in an area directly north of Site 1 (now designated as Site 1-A). This expansion area consisted of mixed iceplant and saltgrass (*Distichlis spicata*) as the dominant species and was designated in the project map as Site 1-B (Figure 5). The total aerial

extent ("footprint") of the restoration area at the end of Year 3 covered 1.15 acres (4,654 m^2) within the 3-acre permitted restoration area. During Year 4, ongoing site maintenance occurred throughout the previous project footprint of all prior years, and restoration activities continued to expand north of Site 1-B in very similar habitat (e.g., iceplant and saltgrass mix). The Year 4 area (designated as Site 1-C) expanded the project by 0.40 acres (1,620 m^2) for a total of 1.55 acres across all years (6,270 m^2). During Year 5, ongoing site maintenance occurred throughout the previous project footprint of all prior years, and restoration activities continued to expand north of Site 1-C in very similar habitat (e.g., iceplant and saltgrass mix). The Year 5 area (designated as Site 1-D) expanded the project by 0.16 acres (648 m^2) for a total of 1.71 acres across all years (6,921 m^2). The Year 6 area (designated Sites 1-E and 2-E) expanded the project by 0.52 acres (2,104 m^2) for a total of 2.23 acres across all years (9,024 m^2).

Overall, restoration events were highly successful, with enthusiastic groups of engaged community members, local residents, and student participants. During Year 1, 181 volunteers contributed 525 hours of service across 12 restoration events. During Year 2, 66 volunteers contributed 165 hours of service across eight public restoration events. During Year 3, 108 volunteers contributed 324 hours across nine community restoration events. In Year 4, 102 volunteers contributed 204 hours across 12 restoration events. During Year 5, public community events were halted due to COVID-19 restrictions from health agencies. During Year 6, restoration events resumed with COVID safety measures in place. Year 6 events consisted of 149 volunteers contributing 298 hours across 12 restoration events. For all years combined, 606 volunteers contributed 1,516 hours across 53 community restoration events (Table 1).

At the start of each event, an informational safety and cultural resource speech and introduction was given that also included a brief history of the Reserve, and the importance of healthy wetlands. All participants signed-in and turned in a waiver to track participation over time. Additional hours were contributed by several students and interns helping with scientific monitoring, as well as events focused on transferring biomass from restoration events to a green waste dumpster off-site.

Implementation of restoration activities in the time of COVID-19 requires extensive preparation to prioritize human health, reduce safety risks, and follow state and local guidance. This included temporarily postponing all on-site activities for a short period and cancelling all public events in Year 5. During Year 6, events resumed with COVID safety measures in place, such as face coverings, social distancing, and participant caps on events. The implementation of safety measures was based upon recommendations made by public health officials and TBF's internal COVID policies.

One of the project goals was to increase community engagement, stewardship, and volunteer participation, and this goal was met successfully. Participants were engaged in many ways, including direct participation, a public project webpage, social media, word-of-mouth, and directly reaching out to schools and community members. All public restoration events (during the public time of the CDP permit) were open to sign-ups from the public, and everyone who offered help was met with a positive response. Loyola Marymount University Coastal Research Institute (CRI) regularly had student internship participation in Year 6. This project allowed well managed temporary public access in a restricted coastal habitat area of the Reserve that was previously inaccessible, encouraging educational and hands-on opportunities for learning in an urban wetland environment.

During Year 6, six non-public restoration and site maintenance events were also opportunistically conducted by TBF staff, project partners, and interns, focused on the removal of non-native vegetation such as radish, crown daisy, iceplant, and Geraldton carnation weed (Figures 3-4). Site maintenance events were conducted throughout the project area, allowing for the removal of targeted invasive vegetation over time.

Figure 3. Restoration activities being conducted by staff and interns 31 January 2022 (top) and 5 April 2022 (bottom).

Table 1. Summary of community restoration event statistics through March 2022.

Year	Event Date / Time	Site	# Volunteers	# Volunteer Hours	Restoration Method
Year 1	1 September 2016	1-A	9	27	Tarping + Hand-restored
	1 September 2016	1-A	9	27	Tarping + Hand-restored
	6 September 2016	2-A	11	25.5	Tarping + Hand-restored
	6 September 2016	2-A	13	39	Tarping + Hand-restored
	8 September 2016	3	9	19.5	Tarping + Hand-restored
	8 September 2016	1-A; 3	8	24	Hand-restored
	13 September 2016	1-A; 2-A	9	16.5	Hand-restored
	16 September 2016	1-A; 2-A	5	15	Hand-restored
	20 October 2016	1-A	10	22.5	Hand-restored
	10 November 2016	1-A	2	6	Hand-restored
	15 November 2016	1-A; 2-A	60	240	Hand-restored
	18 November 2016	1-A	36	63	Hand-restored
	Subtotal	----	**181**	**525**	----
Year 2	27 September 2017	1-A; 3	5	12.5	Hand-restored
	13 October 2017	1-A	7	17.5	Hand-restored
	17 October 2017	1-A	2	5	Hand-restored
	25 October 2017	1-A	6	15	Hand-restored
	15 November 2017	2-A	13	32.5	Hand-restored
	27 February 2018	1-A	6	15	Hand-restored
	6 March 2018	1-A	1	2.5	Hand-restored
	13 March 2018	1-A	26	65	Hand-restored
	Subtotal	----	**66**	**165**	----
Year 3	19 September 2018	1-B	15	45	Hand-restored
	22 September 2018	1-B	36	108	Hand-restored
	27 September 2018	2-A; 1-B	1	3	Hand-restored
	4 October 2018	1-B	3	9	Hand-restored
	24 October 2018	3; 1-B	11	33	Hand-restored
	14 November 2018	1-B	15	45	Hand-restored
	30 January 2019	1-A; 3-A	4	12	Hand-restored
	27 February 2019	1-A	14	42	Hand-restored
	13 March 2019	1-A	9	27	Hand-restored
	Subtotal	----	**108**	**324**	----
Year 4	14 September 2019	1-A	5	10	Hand-restored
	9 October 2019	1-B	5	10	Hand-restored
	23 October 2019	1-B	19	38	Hand-restored
	13 November 2019	1-C	26	52	Hand-restored
	11 December 2019	1-C	3	6	Hand-restored
	8 January 2020	1-C	2	4	Hand-restored

Year	Event Date / Time	Site	# Volunteers	# Volunteer Hours	Restoration Method
	15 January 2020	1-C	6	12	Hand-restored
	29 January 2020	1-C	13	26	Hand-restored
	4 February 2020	1-C	0	0	Hand-restored
	13 February 2020	1-C	5	10	Hand-restored
	19 February 2020	1-C	13	26	Hand-restored
	4 March 2020	1-C	5	10	Hand-restored
	Subtotal	----	**102**	**204**	----
Year 5	** Public events halted due to COVID-19 restrictions. No volunteers. **				
Year 6	11 August 2021	1-D	4	8	Hand-restored
	25 August 2021	1-D	13	26	Hand-restored
	8 September 2021	1-D	5	10	Hand-restored
	22 September 2021	1-D	3	6	Hand-restored
	13 October 2021	2-E	8	16	Hand-restored
	30 October 2021	2-E	22	44	Hand-restored
	10 November 2021	2-E	13	26	Hand-restored
	13 November 2021	1-E	19	38	Hand-restored
	4 December 2021	1-E	16	18	Hand-restored
	11 December 2021	1-E	9	18	Hand-restored
	19 February 2022	1-A	32	64	Hand-restored
	12 March 2022	2-A	5	10	Hand-restored
	Subtotal	----	**149**	**298**	----
	Six Year Total		**606**	**1,516**	

Table 2. Restoration events and maintenance conducted by TBF staff, interns, and / or project partners only. Note: targeted events were not allowed in Year 1 due to permit restrictions.

Year	Event Date / Time	Site
2	23 August 2017	1-A; 3-A
	20 March 2018	1-A
	18 April 2018	1-A
	24 April 2018	1-A
	1 May 2018	1-A
	8 May 2018	1-A; 2-A
	11 May 2018	1-A; 2-A
	17 May 2018	1-A
	19 May 2018	1-A
	11 July 2018	2-A
	19 July 2018	1-A; 2-A
3	1 August 2018	1-A
	8 August 2018	1-A; 1-B

Year	Event Date / Time	Site
	29 August 2018	1-B
	8 February 2019	3-B
	26 April 2019	1-A; 3-B
	22 May 2019	1-A
	11 June 2019	1-A; 3-A; 3-B
	12 June 2019	1-A; 3-A; 3-B
	21 June 2019	1-A; 3-A; 3-B
	24 July 2019	3-A; 3-B
4	23 August 2019	1-A
	13 September 2019	1-A
	18 September 2019	1-A
	20 September 2019	1-A
	10 October 2019	1-A; 1-B
	26 November 2019	3-B
	23 January 2020	1-A; 1-B
	20 February 2020	1-A; 1-B
	19 March 2020	1-B; 3-A; 3-B
	22 April 2020	1-B; 3-A; 3-B
	5 June 2020	1-A; 3-A; 3-B
	16 June 2020	1-C
	24 June 2020	1-B; 1-C
	17 July 2020	1-C
	22 July 2020	1-A, 3-A, 3-B
	30 July 2020	1-A
5	4 August 2020	1-A
	12 August 2020	1-A
	19 August 2020	1-A
	10 September 2020	1-A
	22 September 2020	1-C, 1- D
	13 October 2020	3-B
	17 November 2020	1-A, 3-A, 3-B
	18 November 2020	1-A, 3-A, 3-B
	19 November 2020	1-A, 3-A, 3-B
	20 November 2020	1-A, 1-B 3-A, 3-B
	25 November 2020	2-A
	9 December 2020	2-A
	14 December 2020	1-C, 1-D
	23 December 2020	2-A, 3-A, 3-B
	7 January 2021	1-A, 3-A, 3-B

Year	Event Date / Time	Site
	3 February 2021	1-A, 3-A, 3-B
	16 February 2021	1-A, 3-A, 3-B
	23 February 2021	1-A, 1-D, 3-A, 3-B
	3 March 2021	1-A, 3-A, 3-B
	17 March 2021	1-A, 3-A, 3-B
	1 April 2021	1-A, 3-A, 3-B
	15 April 2021	1-A, 3-A, 3-B
	20 April 2021	1-A, 3-A, 3-B
	27 April 2021	1-A, 3-A, 3-B
	3 May 2021	1-A, 3-A, 3-B
	11 May 2021	1-A, 3-A, 3-B
5	15 June 2021	1-A, 3-A, 3-B
	23 June 2021	2-A
	7 July 2021	1-A, 3-A, 3-B, 1-D
	14 July 2021	1-B, 1-C
	21 July 2021	1-B, 1-C, 1-D
6	22 October 2021	1-D
	31 January 2022	3-A, 3-B
	5 April 2022	3-A, 3-B
	21 April 2022	3-A, 3-B
	26 April 2022	1-A, 3-A, 3-B,
	30 June 2022	1-D

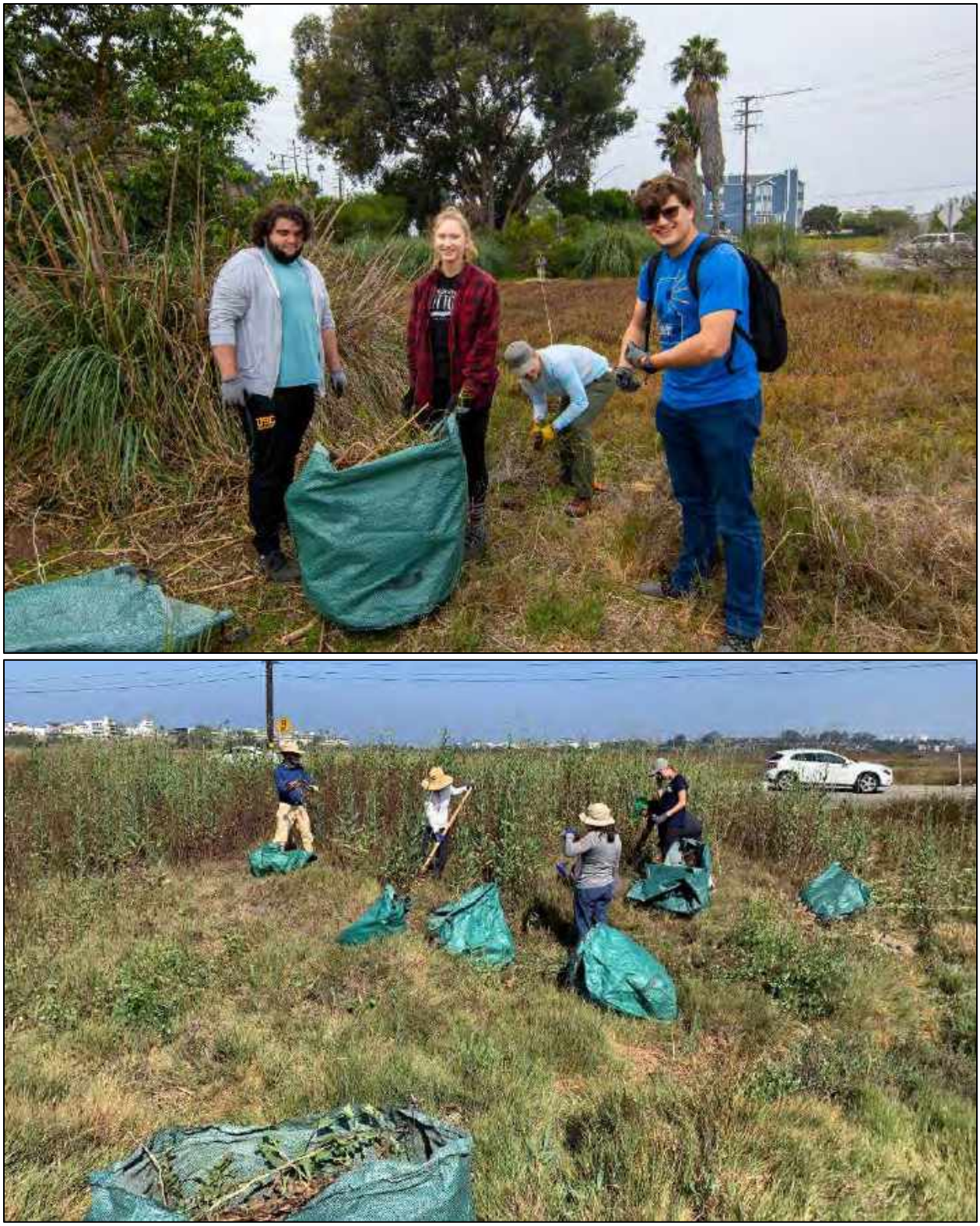


Figure 4. TBF staff and interns helping pull non-native plants on 17 November 2021 (top) and 30 June 2022 (bottom).

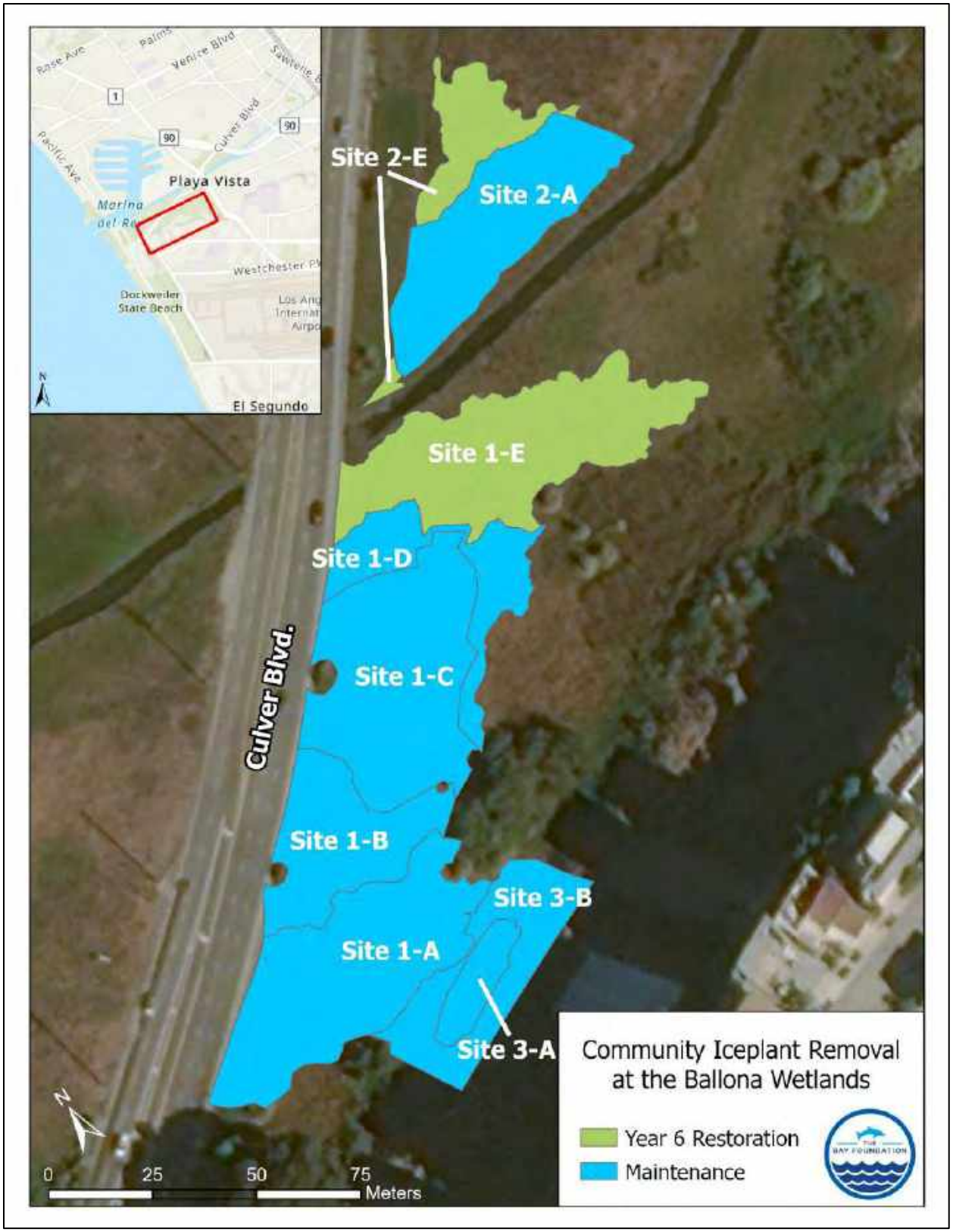


Figure 5. Map of restoration site showing new restoration for Year 4, August 2019 to July 2020 (light green) and maintenance areas from previous years (light blue).

Revegetation Activities

The first step of revegetation of the restoration project allowed for a passive evaluation of natural native vegetation recruitment based on the existing seed bank without soil disturbance (recommended by CDFW and their Native American consultant). This scientific evaluation occurred for a period of two years after iceplant removal. While some areas experienced significant recruitment of native species like saltgrass and alkali weed (*Cressa truxillensis*), some of the restoration areas still had patchy or low levels of native cover and adaptive management actions were taken to enhance native plant cover through seeding and container stock planting.

During Year 3, TBF coordinated with CDFW to develop plans for revegetation efforts in portions of Site 1-A and Site 3-A / 3-B, which had higher proportions of bare ground. Revegetation Protocol 2 and Protocol 3, as detailed in the project Implementation and Monitoring Plan, were used in targeted areas of the initial restoration area with a goal of increasing native plant recruitment (TBF 2016). A coastal upland scrub seed mix was established in partnership with CDFW and a Native American consultant and distributed on the hillside of Site 3-A and portions of Site 3-B on 8 February 2019. Additionally, TBF installed saltgrass rhizome cuttings in a small portion of Site 1-A in late February into early March. For additional details on Year 3 revegetation activities, refer to the Year 3 Report (Johnston et al. 2019). Revegetation activities were reevaluated in Year 4 after the growth season for the annual species.

As a part of Year 4 revegetation activities, Loyola Marymount University's (LMU) Coastal Research Institute (CRI) initiated a research project to evaluate the potential of plant-microbe interactions on native plant species such as saltgrass and alkali weed to potentially enhance plant growth and germination. The project evaluated scarification methods, an assessment of optimal growth conditions, mesocosm revegetation experiments, and isolated microbes from soil and roots to augment naturally present bacteria for field inoculations during revegetation. Preliminary findings determined that moderate-grit sandpaper scarification increased alkali weed germination from 16% to 92% and whole rhizome transplants of saltgrass increased survival.

Additionally, during Year 4, plans were initiated to continue revegetation activities, including container stock planting, but beginning in July 2019, a series of illegal vehicle incursions and subsequent sediment dumping on site caused significant damage to the hillside area (Sites 3-A and 3-B) and portions of the lower restoration area (Site 1-A and a small portion of Site 1-B). Subsequent to these impacts, the Coastal Commission asked TBF to refrain from project activities within these areas for a duration of time while they entered into discussions with the alleged violator. Additional details on the impacted areas and activities can be found in the "Challenges" section of this report.

During Year 5, TBF implemented extensive container stock planting and native seeding throughout much of the project area, with emphasis on the impacted areas noted above once Coastal Commission completed resolution of the violation. On 17-20 and 25 November 2021, TBF, along with interns, FBW, CDFW, and the Los Angeles Conservation Corps (LACC) conducted removal of non-native vegetation, installation of erosion control matting on the hillside (Sites 3-A and 3-B), planting of 1,480 native container stock plants, and seeding of 34.25 lbs of native plant seed (Figure 6). E. Read and Associates, Inc. assisted in transporting biomass resulting from non-native vegetation removal off-site for disposal in

a green waste dumpster. While these efforts were focused within the impacted areas of the site, some supplemental planting and seeding occurred throughout the restoration area.

No supplemental revegetation actions occurred during Year 6; however, species planted the previous reporting year (Year 5) continued to establish and cover much of the hillside (Sites 3-A and 3-B; Figure 7). Notable native species in this area include California sagebrush (*Artemisia californica*), seacliff buckwheat (*Eriogonum parvifolium*), branching phacelia (*Phacelia ramossissima*), and white sage (*Salvia apiana*).

Figure 6. Photos taken of hillside following disturbance (top, 26 November 2019) and during Year 5 revegetation activities (bottom, 18 November 2021).

Figure 7. Photo taken of hillside during Year 6, approximately one and a half years after revegetation activities (3 June 2022).

Scientific Monitoring

A rigorous scientific monitoring plan informs adaptive management of restoration activities. Table 4 summarizes the biological monitoring sampling design. It lists five major parameters, the primary protocol(s) implemented for each parameter, and the frequency of implementation. Event statistics (e.g., volunteer hours) and revegetation efforts are reported above. Additionally, cultural resource monitoring occurred during all restoration events and activities, but since no items were found as part of this project implementation, there are no results presented.

Pre-restoration, or baseline, surveys were conducted in July and August 2016, prior to the initiation of restoration activities. The "during project" surveys were conducted during tarping and restoration events, and the post-restoration evaluation surveys were conducted in accordance with the post-restoration frequency listed in Table 3 from the project Implementation and Monitoring Plan. Additionally, site checks were conducted bi-weekly during tarping implementation (late summer 2016 only), and supplemental surveys (especially for birds and other wildlife) were often conducted in association with restoration events. Though most of the site is more than two years post-restoration, monitoring will continue while new restoration activities are being undertaken. Figure 6 shows photographs from a scientific monitoring activity.

Table 3. Description of biological protocols implemented during pre-restoration baseline monitoring, implementation monitoring, post-restoration monitoring, and their minimum frequency of occurrence.

Parameter	Protocol	Pre-Restoration (Baseline)	During Project	Post-Restoration (Evaluation)	Post-Restoration Frequency
Invasive Vegetation Cover	GPS and GIS; Transect / Quadrat Cover	✓		✓	Semi-annually for two years
Seedling Density	Quadrat Density Counts			✓	Quarterly for two years
Avifauna (Bird)	Visual Surveys for Presence and Behavior	✓	✓	✓	Immediately post-restoration and annually for two years
Other Wildlife (Mammals and Herpetofauna)	Visual Surveys for Presence	✓	✓	✓	Immediately post-restoration and annually for two years
Photo-Point	Permanent Photo-Points	✓	✓	✓	Immediately post-restoration and quarterly for two years

Summaries of the pre- and post-restoration monitoring methods and results are included below. ***Note that species lists are not meant to be exhaustive or statistically relevant, they are just documentation of the variety of flora and fauna that were identified on project surveys and monitoring days.***

Vegetation

The composition and distribution of vegetation species across wetland habitats directly affects many ecosystem functions such as productivity, soil composition, and nitrogen and carbon exchange dynamics (Schwartz et al. 2000, Keer and Zedler 2002). Vegetation cover surveys were used to provide a wide range of information and data, including summarizing the prevalence of native and non-native plant cover in each habitat, determining species cover, and species richness. Additionally, a seedling density survey was conducted on restored areas, with a focus on geospatially tagging new growth of iceplant within the restoration areas and identifying seedlings within fixed transect locations. Restoration efforts expanded in Year 6 (see maps and restoration activity information above); thus, the results presented below combine both prior efforts and new restoration activities.

Overall Summary of Vegetation Results

Overall results indicated a significant reduction in non-native vegetation cover in most areas and an increase in native vegetation cover. The initial non-native decrease was due primarily to the removal of 100% of the iceplant cover, followed by the subsequent return of several “weedy” non-native vegetation invaders. The estimates of non-native vegetation reduction are likely conservative, given that pre-restoration “baseline” surveys were conducted in the summer of 2016 after the annual non-native species would have died and would not have been captured in the cover data. Significant expansion and new growth of native vegetation occurred, in some areas many times greater than pre-restoration cover. Additionally, native species richness has increased across the site, especially in areas that had container stock plantings. Mapping results encompass the most area for cover assessment and displayed a similar trend.

Sites 3-A, 3-B, and parts of Sites 1-A and 1-B experienced severe illegal disturbances in Year 4, including multiple vehicle and construction truck incursions, dumping of sediment on site (Site 3-B), and impacts associated with those two disturbances. For additional details on the disturbances, see the Year 5 Report. Erosion control mats were broken, new native seedlings were trampled or uprooted, and soil was severely disturbed. These impacts negatively affected vegetation cover, especially in Sites 3-A and 3-B. However, in Year 5, the Coastal Commission resolved the alleged violations and TBF began revegetation activities in November 2020, after receiving approval for resumption of activities. A significant amount of work was conducted in the impacted area to revegetate with native plants using container stock and seeding the areas. At the same time, smaller numbers of container stock and seed were distributed in other areas of the site experiencing mostly bare ground or non-native annuals. Year 6 results reflect an increase in native cover in these areas.

Mapping surveys illustrate the effectiveness of maintenance activities, showing a decrease in non-native vegetation cover overall, followed by a recorded increase when the new sites were added to the whole project area. Overall, non-native cover decreased from pre-restoration, and native cover increased, though the specific pattern varied by site and season, especially regarding annual species. During Year 6, TBF began expanding restoration efforts, identified as Sites 1-E and 2-E in Figure 5. While native cover and species richness is increasing slowly over time, ongoing maintenance is still recommended throughout all Sites for future years, especially targeting non-native annuals.

Adaptive management recommendation actions are included in other chapters of this report to address non-native vegetation invasion and additional revegetation conducted in Year 5 to further supplement the project areas. The following Figures 7-9 display a variety of representative locations within the restoration project footprint following iceplant removal with various combinations of native and non-native vegetation assemblages.

Figure 6. TBF staff conducting monitoring on 17 November 2021.

Figure 7. Mixed native and non-native plant assemblages (13 May 2022); mixed native saltgrass and pickleweed and non-native rabbit's foot grass, prickly lettuce, and sowthistle (top); mixed predominantly native saltgrass with some individuals of fat hen and other non-native species (bottom).

Figure 8. Predominantly non-native vegetation assemblage dominated by iceplant prior to hand removal on 11 December 2021 (top) and after (bottom). Note photograph locations are approximate.

Figure 9. Vegetation assemblages consisting primarily of mixed native saltgrass and pickleweed (top) and mixed native saltgrass and big saltbush (bottom) (7 July 2021).

Vegetation Mapping Survey Methods

Vegetation mapping methods employed *A Manual of California Vegetation* (Sawyer et al. 2009) as the standard for classification and delineation of most native and many non-native vegetation alliances and associations based on the presence and relative cover of co-dominant species. An updated version of the Manual can also be found online at explorer.natureserve.org.

Vegetation mapping protocols are described in detail in SOP 3.5 Vegetation Mapping (TBF 2015a). This protocol outlines a synthesized vegetation stand delineation strategy based on a combination of aerial imagery, office digitization (commonly in ArcGIS), and *in situ* field verification. This method used a Trimble GPS unit and ArcGIS software to produce detailed, geospatially rectified vegetation maps, allowing for an analysis of vegetation alliance and association coverage. Post-restoration field surveys were conducted semi-annually in May 2017, October 2017, May 2018, November 2018, June 2019, November 2019, June 2020, November 2020, May 2021, November 2021, and June 2022. Please note that the terms "exotic" and "non-native" are used interchangeably throughout this section.

Vegetation Mapping Survey Results

Vegetation mapping results displayed an increase in native cover compared to pre-restoration conditions (as evaluated by the dominant cover classification of each polygon). Results also displayed a decrease in non-native cover compared to pre-restoration, but a higher non-native cover than Year 2, which is accounted for in part by adding newly restored areas (all sites were combined for the mapping analyses). Additionally, a decrease in unvegetated area was documented since October 2017, which identified the highest cover of unvegetated area. Native cover was predominantly made up of saltgrass in the Year 6 surveys, with many other wetland and adjacent habitat species. Non-native cover and species varied by polygon. While these results show a substantial change in the condition of the site from the baseline of iceplant monocultures and intermixed iceplant with other species, they should not be interpreted alone, and additional data will allow for longer-term trends to be analyzed in future reports.

Figure 10a is a map displaying baseline (pre-restoration) dominant vegetation type GIS polygons classified as iceplant monocultures (approximately 49% of the total project area) or non-native vegetation (approximately 51% of the total project area). The non-native vegetation polygons were also predominantly iceplant, but some areas contained intermixed saltgrass, especially the western border adjacent to Culver Boulevard. The iceplant present in these intermixed areas was hand-pulled.

For post-restoration data, polygons displaying native vegetation classifications may also contain small patches of non-native vegetation; similarly, non-native vegetation classifications may also contain small patches of native vegetation. Additionally, new iceplant growth individual plants are indicated on the map as black triangles (e.g., Figure 10b). New iceplant growth was mapped in the survey following initial restoration efforts. While current site observations find occasional iceplant sprouts, these iceplant spouts are pulled immediately, and not present during monitoring efforts. Figures 10b – 10h display post-restoration data and are summarized individually below.

Figure 10b is a map displaying Year 1 post-restoration dominant vegetation type within GIS polygons classified as native, non-native, or mixed nativity surveyed on 2 May 2017. Sites 1-A and 2-A both had

some areas with new iceplant growth: 35 small individual plants sprouted in Site 1-A, and 5 small individual plants sprouted in Site 2-A. Desiccated iceplant "mulch" areas where no native or non-native vegetation re-growth had occurred yet accounted for approximately 14% of the total project area. Polygons dominated by non-native vegetation covered approximately 59% of the total project area, and polygons dominated by native or mixed vegetation assemblages covered approximately 28% of the total project area. The polygons did not account for bare ground or "mulch" areas that are intermixed with native or non-native vegetation.

Figure 10c is a map displaying Year 2 post-restoration dominant vegetation type within GIS polygons classified as native, non-native, mixed nativity, or unvegetated surveyed in October 2017. Over 40% of the site was classified as native, with approximately the same amount of the site classified as unvegetated, spread across all Sites. The western edges of Sites 1-A and 2-A are starting to fill in with native vegetation, predominantly saltgrass. Site 3-A remains primarily unvegetated and non-native, even after adaptive maintenance actions and restoration events took place. A large portion of the sites remain unvegetated during this survey.

Figure 10d is a map displaying Year 2 post-restoration dominant vegetation type within GIS polygons classified as native, non-native, mixed nativity, or unvegetated surveyed in May 2018. During this survey, over 50% of the total restoration area was classified as native, with approximately 9% of the area as non-native and approximately 35% as unvegetated, a decline in unvegetated area from the October 2017 survey. Unvegetated area remains primarily in Sites 1-A and 3-A, with patchy non-native in multiple places, but large areas of dominant native cover, a significant change from pre-restoration baseline conditions.

Figure 10e is a map displaying Year 3 post-restoration dominant vegetation type within GIS polygons classified as native, non-native, mixed nativity, or unvegetated surveyed in November 2018. During this survey, 43.5% of the total restoration area was classified as native, with 23.3% of the area as dominated by non-native vegetation and 25.9% identified as mixed nativity. The largest polygons dominated by non-native cover were in Sites 3-A and 3-B. Approximately 11% was unvegetated, the lowest in mapping analyses to-date. Native polygons were dominated by saltgrass and alkali weed. Common non-native species identified included non-native grasses, particularly brome species (*Bromus* spp.), wild radish, and mustard. A small patch of Geraldton carnation weed (*Euphorbia terracina*) continues to be managed in Site 3-A. Site 1-B shows dominant native vegetation cover, primarily saltgrass, in the month following restoration activities removing iceplant in that area.

Figure 10f is a map displaying Year 3 post-restoration dominant vegetation type within GIS polygons classified as native, non-native, mixed nativity, or unvegetated surveyed in June 2019. Predominantly native cover was found on just over 32% of the site, which was more than double the initial May 2017 pre-restoration baseline survey (14.6%). Native cover on this survey was dominated by annual Canadian horseweed. Non-native cover was removed from Sites 3-A and 3-B in February 2019 and replaced with biodegradable erosion control matting and hand-broadcast seeding of native plants. While seedlings of several native plants successfully sprouted (see photographs throughout report), they did not achieve a high enough cover to consider the assessment polygons as dominated by native cover. They are identified in map Figure 10f as predominantly 'unvegetated', although that does not imply that the

native seedlings were not present. Mapping results from Site 2-A identified dominant native and mixed-native cover around the periphery, with the interior of the site invaded by non-native brome grasses, wild radish, and annual yellow sweetclover (*Melilotus indicus*). The majority of non-native invasive vegetation were observed to be annual species. Site 1-B continued to show dominant native cover, expansion of saltgrass, similar to post-restoration conditions immediately following the removal of iceplant in Fall 2018.

Figure 10g is a map displaying Year 4 post-restoration dominant vegetation type within GIS polygons classified as native, non-native, mixed nativity, or unvegetated surveyed in November 2019. Predominantly native cover was identified on over 50% of the site, as compared to the initial May 2017 pre-restoration baseline survey of 14.6%. Non-native cover was approximately 20% of the total area (portions of Sites 2-A and 3-B), with a large unvegetated region. Site 1-B and much of Site 1-C were dominated by natives, predominantly saltgrass with some alkali weed, pickleweed (*Salicornia pacifica*), alkali heath (*Frankenia salina*), and other mixed species.

Figure 10h is a map displaying Year 4 post-restoration dominant vegetation type within GIS polygons classified as native, non-native, mixed nativity, or unvegetated surveyed in June 2020. Predominantly native cover was identified in Site 1-C, with mixed nativity in Sites 1-B and 1-A. Site 2-A was dominated by non-native vegetation in the center of the polygons, with native cover around the periphery. Total area dominated by natives made up 40.8% of the restoration area, with non-native at 38.4% and bare ground at only 2.6%, the lowest of any survey to-date. Non-natives were primarily annual weedy grasses, Geraldton carnation weed, radish, and several others (see also Adaptive Management chapter below for details). Targeted restoration events for several of these species and areas occurred after mapping data were collected.

Figure 10i is a map displaying Year 5 post-restoration dominant vegetation type within GIS polygons classified as native, non-native, mixed nativity, or unvegetated surveyed in November 2020. This mapping event occurred prior to intensive restoration activities, including weeding, planting native vegetation, and seeding. Predominantly native cover was identified in most of Site 1-C, with mixed nativity in Site 1-D (new restoration area for Year 5) and Site 1-B. Site 3-A and the southeastern portion of Site 1-A remained largely unvegetated. Site 2-A had native vegetation around the perimeter, including saltgrass and pickleweed, with non-natives dominant on the eastern portion of the area, including radish and mustard. Total area dominated by natives made up 34.0% of the restoration area, with non-native cover at 14.3% and bare ground at 17.5%. The northwestern portions of Sites 1-B and 1-A had intermixed non-native grasses throughout the areas, dominated by bromes.

Figure 10j is a map displaying Year 5 post-restoration dominant vegetation type within GIS polygons classified as native, non-native, mixed nativity, or unvegetated surveyed in May 2021. This mapping event occurred approximately six months after substantial native planting occurred in November 2020 (after the mapping survey from Figure 10i was conducted), primarily in Sites 3-A, 3-B, 1-A, and 2-A. Although Site 3-A was still identified as predominantly non-native, the native species richness of Sites 3-A and eastern 1-A was higher than ever recorded previously, and many of the native container stock species planted survived and increased substantially in size. Non-native cover in these areas was dominated by brome grasses, with some mustard and Geraldton carnation weed. Sites 1-B, 1-C, 1-D, and

2-A were dominated by natives across much of their area. Site 2-A was seeded and planted with container stock, and individuals of alkali heath and woolly seablite (*Suaeda taxifolia*), which has a California Rare Plant Rank 4.2 (California Native Plant Society), were found throughout the northern and eastern areas. Site 1-A was dominated by non-native grasses and small individuals of Geraldton carnation weed and was subsequently weeded during restoration events. Small patches of natives such as saltgrass and alkali weed were also present throughout the areas. Total area dominated by natives made up 56.9% of the restoration area, the highest overall native cover in a survey to date, with non-native cover at 25.3% and bare ground at 10.9%.

Figure 10k is a map displaying Year 6 post-restoration dominant vegetation type within GIS polygons classified as native, non-native, mixed nativity, or unvegetated surveyed in November 2021. This mapping event occurred approximately one year following native planting. Sites 3-A and 3-B, which have historically displayed non-native or unvegetated cover, showed an increase in native cover. Site 1-A was predominantly unvegetated or non-native with small patches of mixed or native cover. Site 1-B was a combination of native and mixed cover. Sites 1-C, 1-D, and 2-A were almost entirely comprised of native cover, with several small unvegetated patches in Site 2-A. Sites 1-E and 2-E were not fully restored until shortly after mapping occurred, thus iceplant still covered much of the sites resulting in higher non-native cover. Total area dominated by natives made up 49.6% of the restoration area, with non-native cover at 30.5% and bare ground at 6.0%. Since sites 1-E and 2-E were added in Year 6 but were not fully restored during this round of mapping, the non-native cover percentage is slightly inflated.

Figure 10l is a map displaying Year 6 post-restoration dominant vegetation type within GIS polygons classified as native, non-native, mixed nativity, or unvegetated surveyed in June 2022. Similar to the previous round of mapping (November 2021), Sites 3-A and 3-B were comprised of a combination of non-native and mixed cover. Sites 1-B and the newly restored 1-E showed a combination of native and mixed cover with little to no patches of non-native cover. Sites 1-A, 1-C,1-D, and the newly restored 2-E showed a combination of native and mixed cover with several patches of non-native cover. The non-native patch in Site 1-A was primarily comprised of brome grass and the non-native patch in Site 1-C and 1-D was primarily comprised of prickly lettuce. Site 2-A shows a mixture of native, non-native, and unvegetated patches. Total area dominated by natives made up 33.0% of the restoration area, with non-native cover at 26.9% and bare ground at 2.6%.

Figure 11 summarizes mapping results over all surveys and proportion of native, non-native, and unvegetated areas. The graph illustrates seasonal variation, with spring surveys generally having higher proportions of non-native annual weedy plant species present. Additionally, the bars represent comprehensive proportions of native and non-native species, including new restoration areas in Years 3-6. Native cover has increased over time from the baseline survey conditions, with seasonal variation. Mapping results differed from the transect-level data (below), due in part to differing methodologies. Both sets of results are presented in this report to provide more comprehensive data analyses. It is also important to note that both the mapping data and cover data represent distinct points in time, and thus, may not represent the “ambient” conditions throughout the whole year, given seasonal variation of plant cover, especially in annual species. Additional years of data will continue to inform long-term trends.

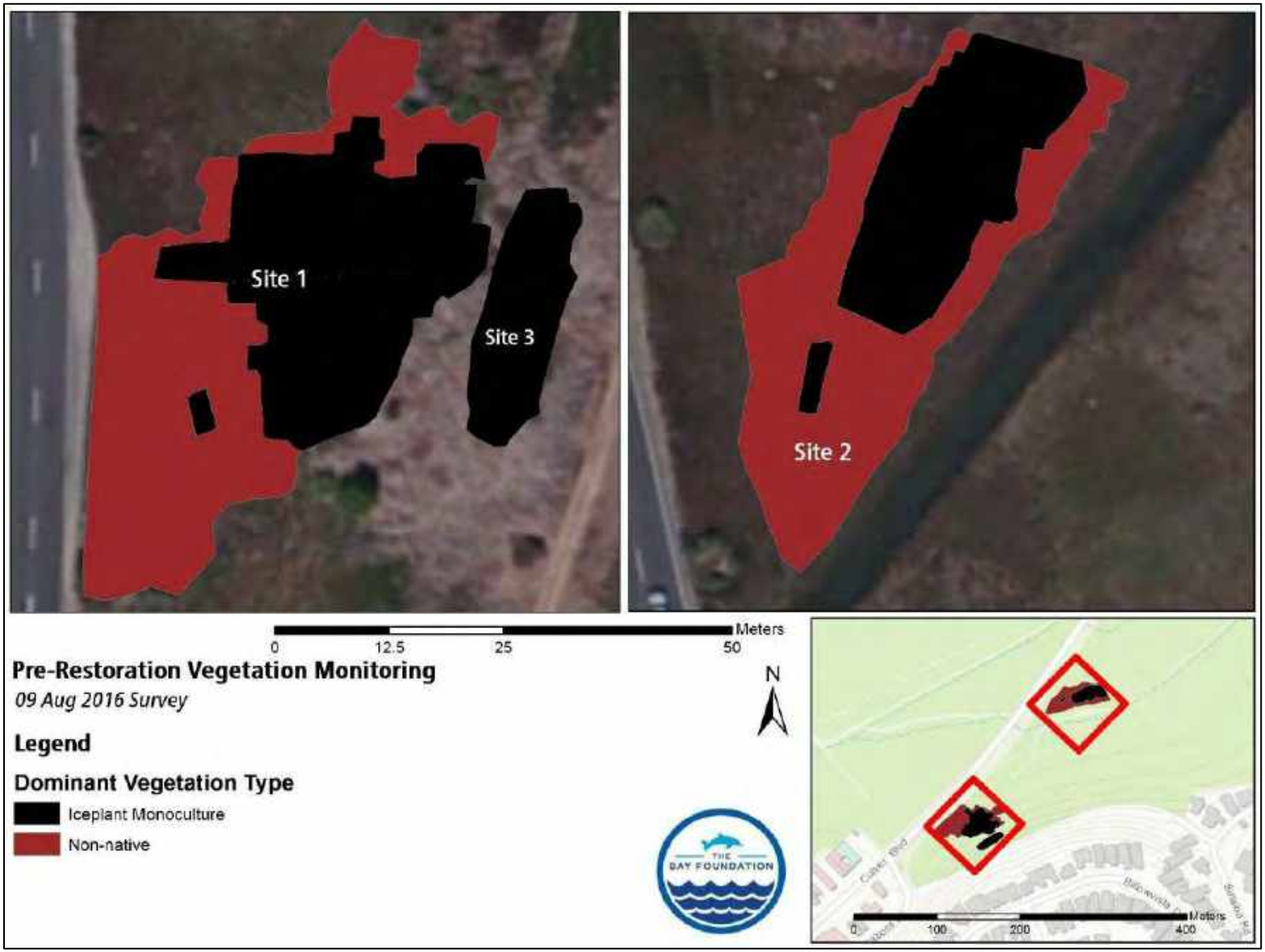


Figure 10a. Map displaying dominant vegetation type within GIS polygons during the 9 August 2016 baseline survey.

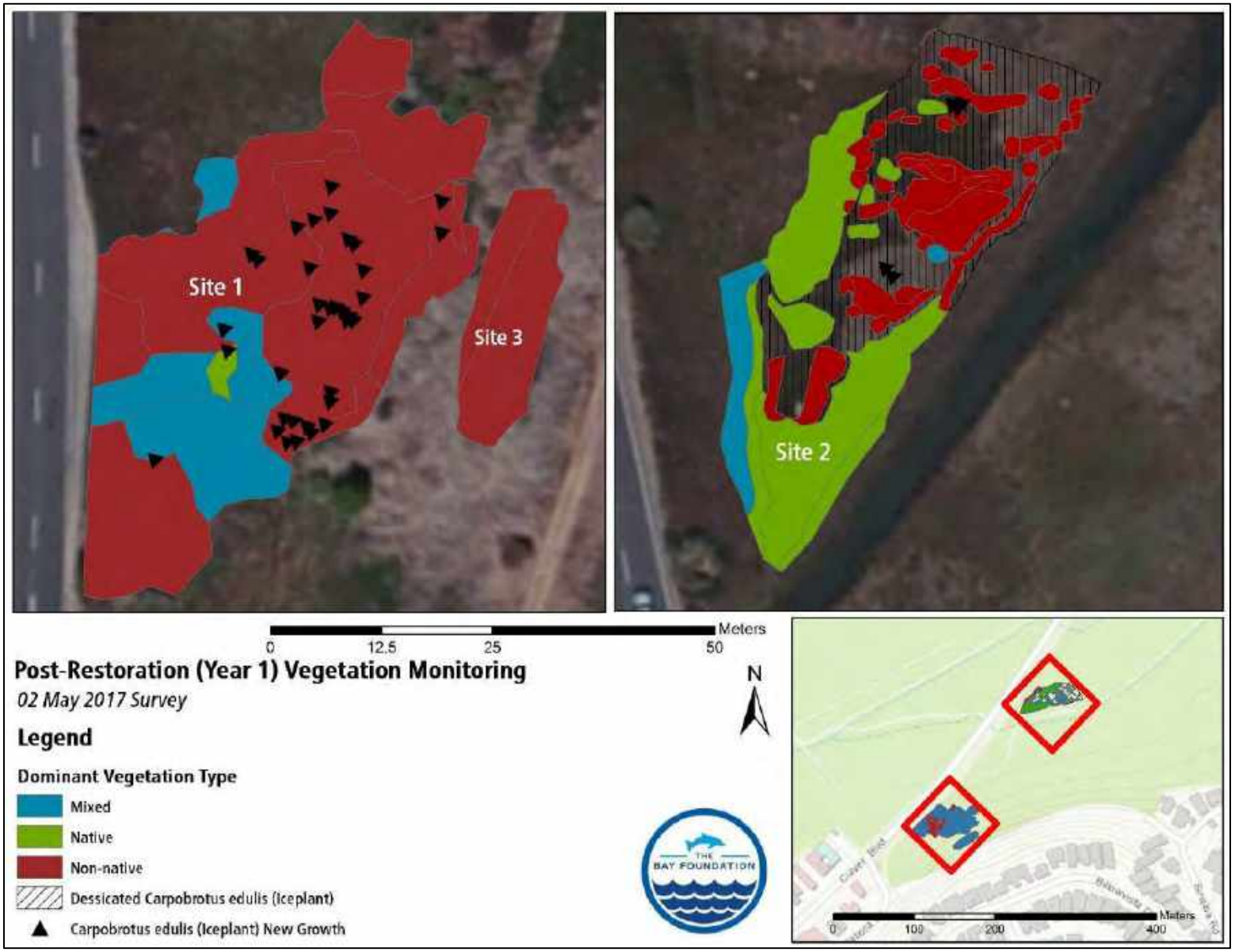


Figure 10b. Map displaying dominant vegetation type within GIS polygons during the 2 May 2017 survey.

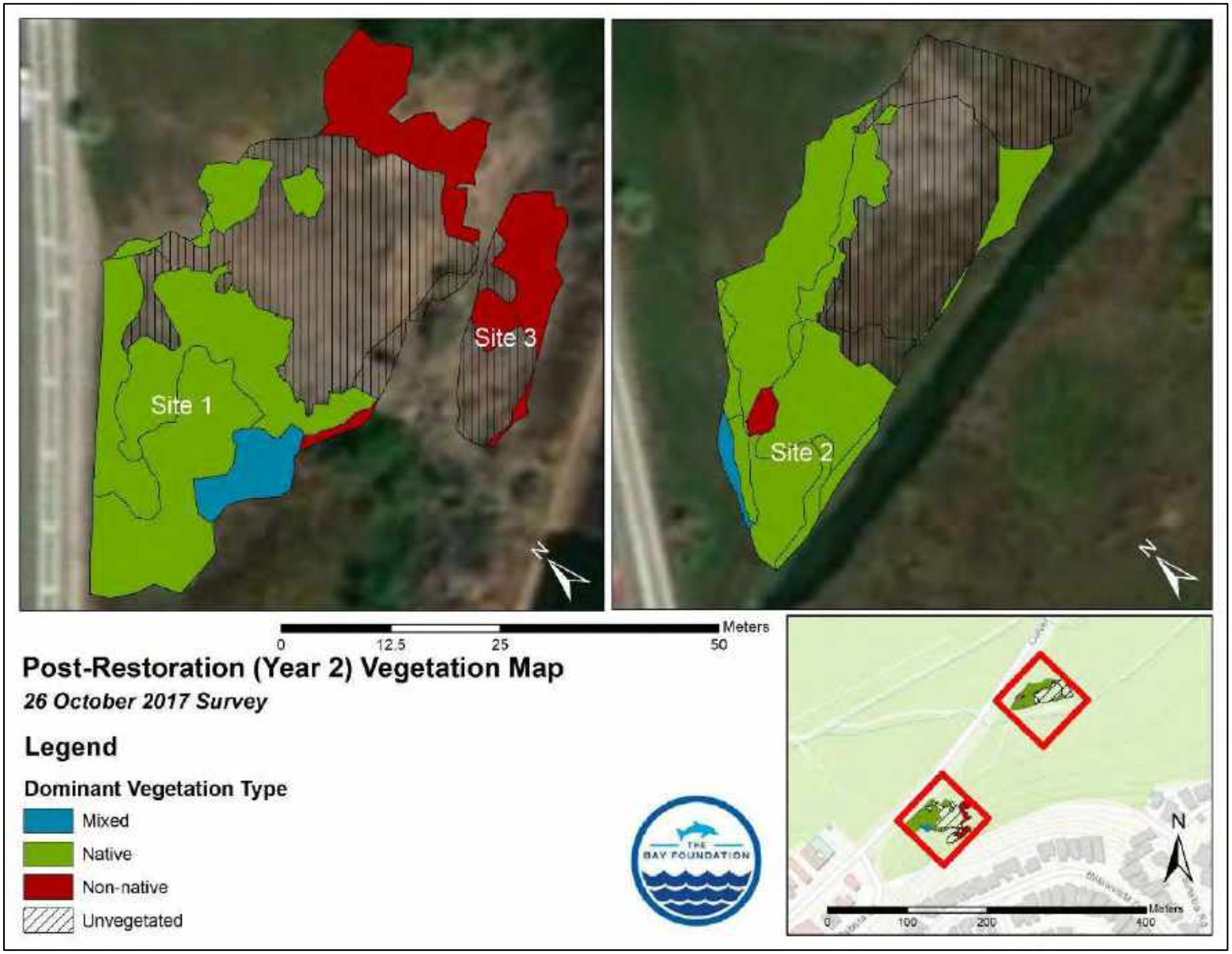


Figure 10c. Map displaying dominant vegetation type within GIS polygons during the 26 October 2017 survey.

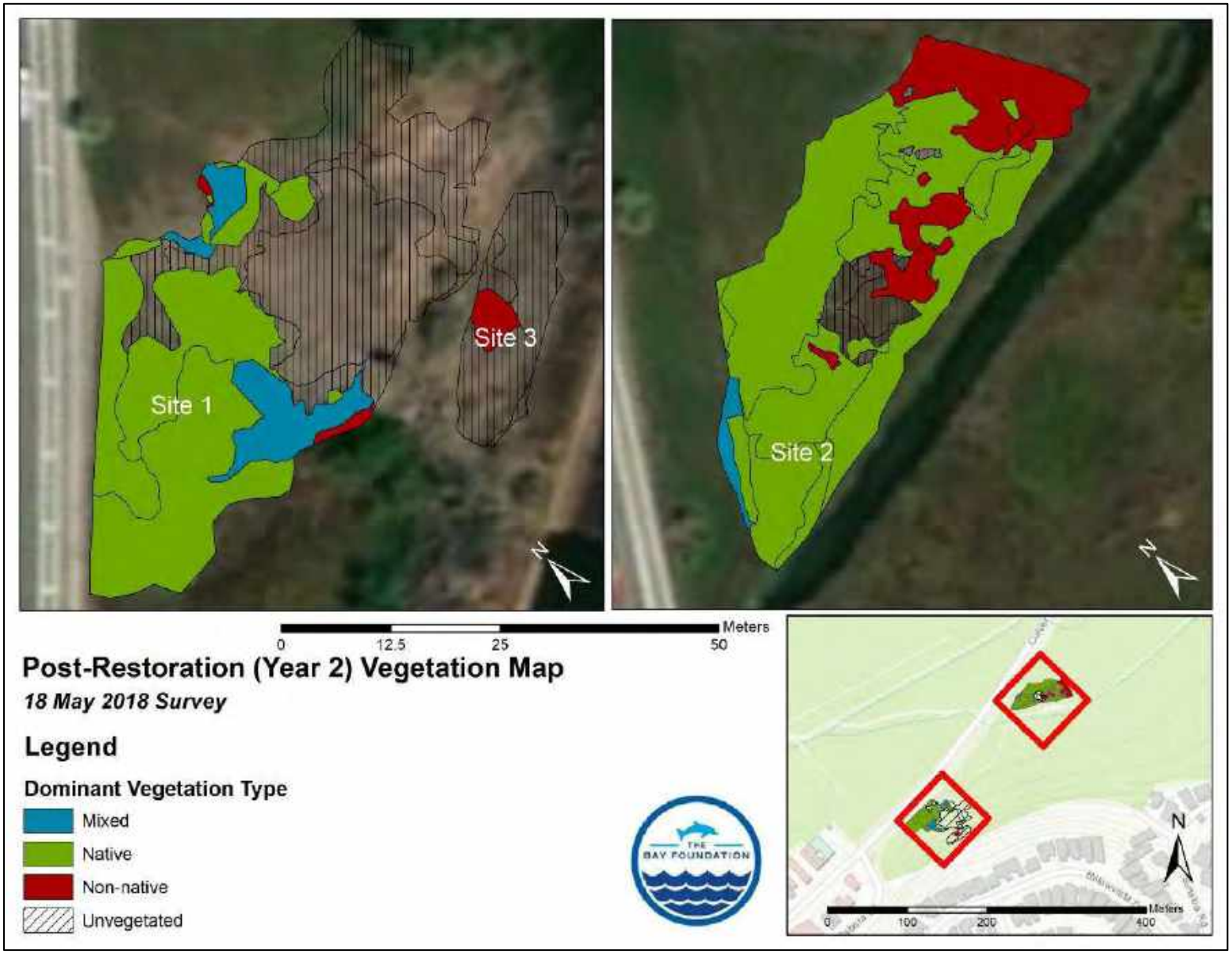


Figure 10d. Map displaying dominant vegetation type within GIS polygons during the 18 May 2019 survey.

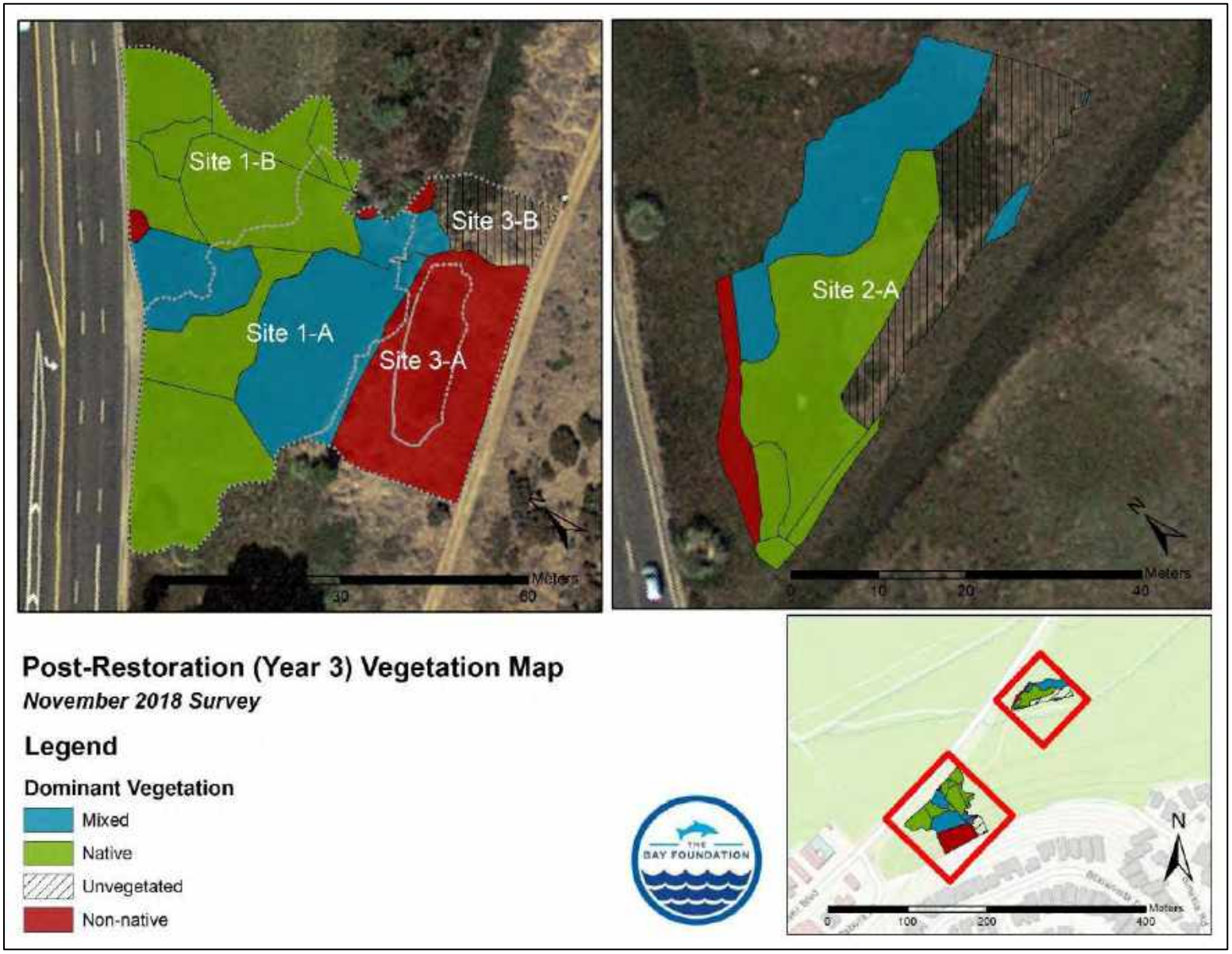


Figure 10e. Map displaying dominant vegetation type within GIS polygons during the 18 November 2018 survey.

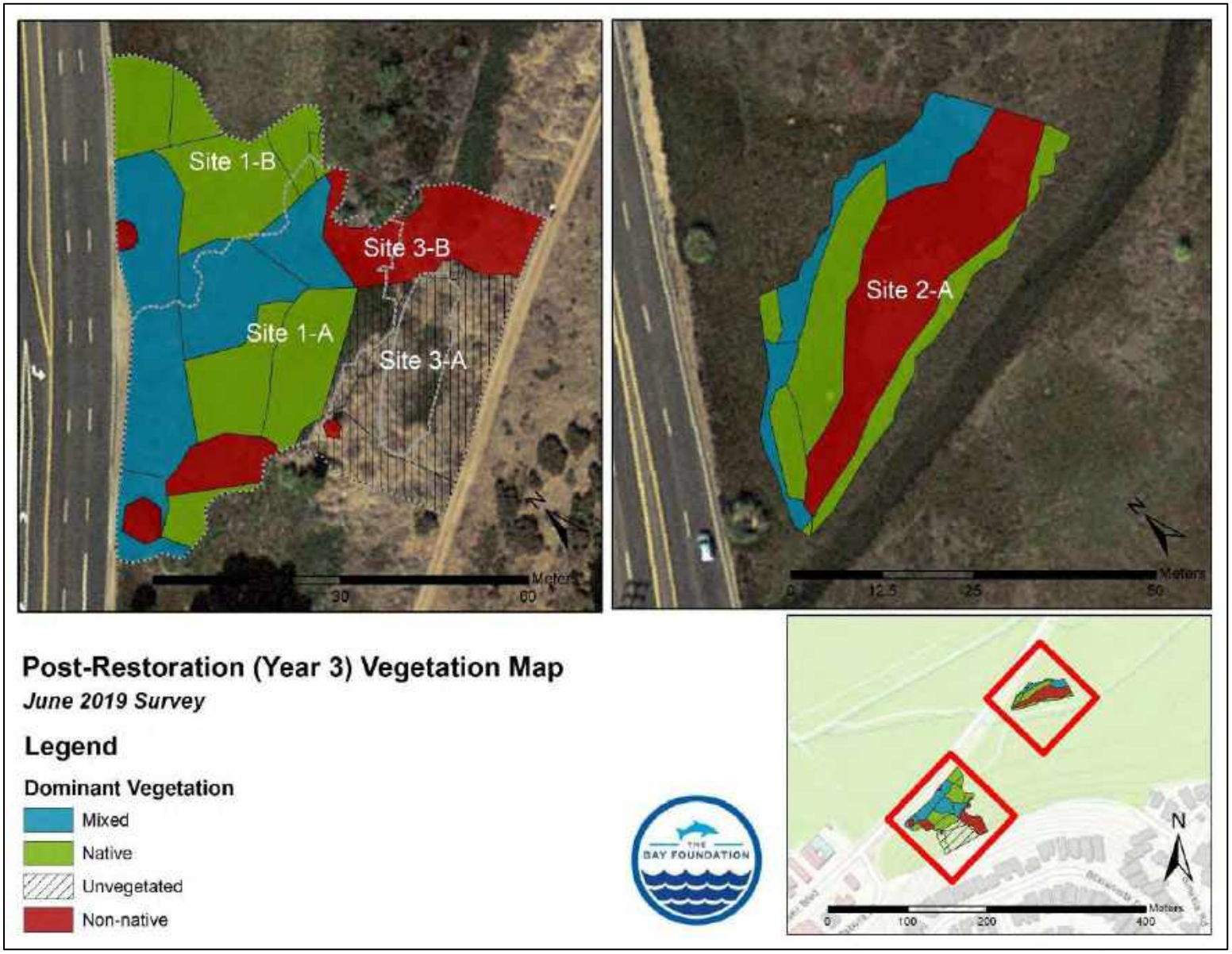


Figure 10f. Map displaying dominant vegetation type within GIS polygons during the 11 June 2019 survey.

Figure 10g. Map displaying dominant vegetation type within GIS polygons during the Fall 2019 survey on 21 November 2019.

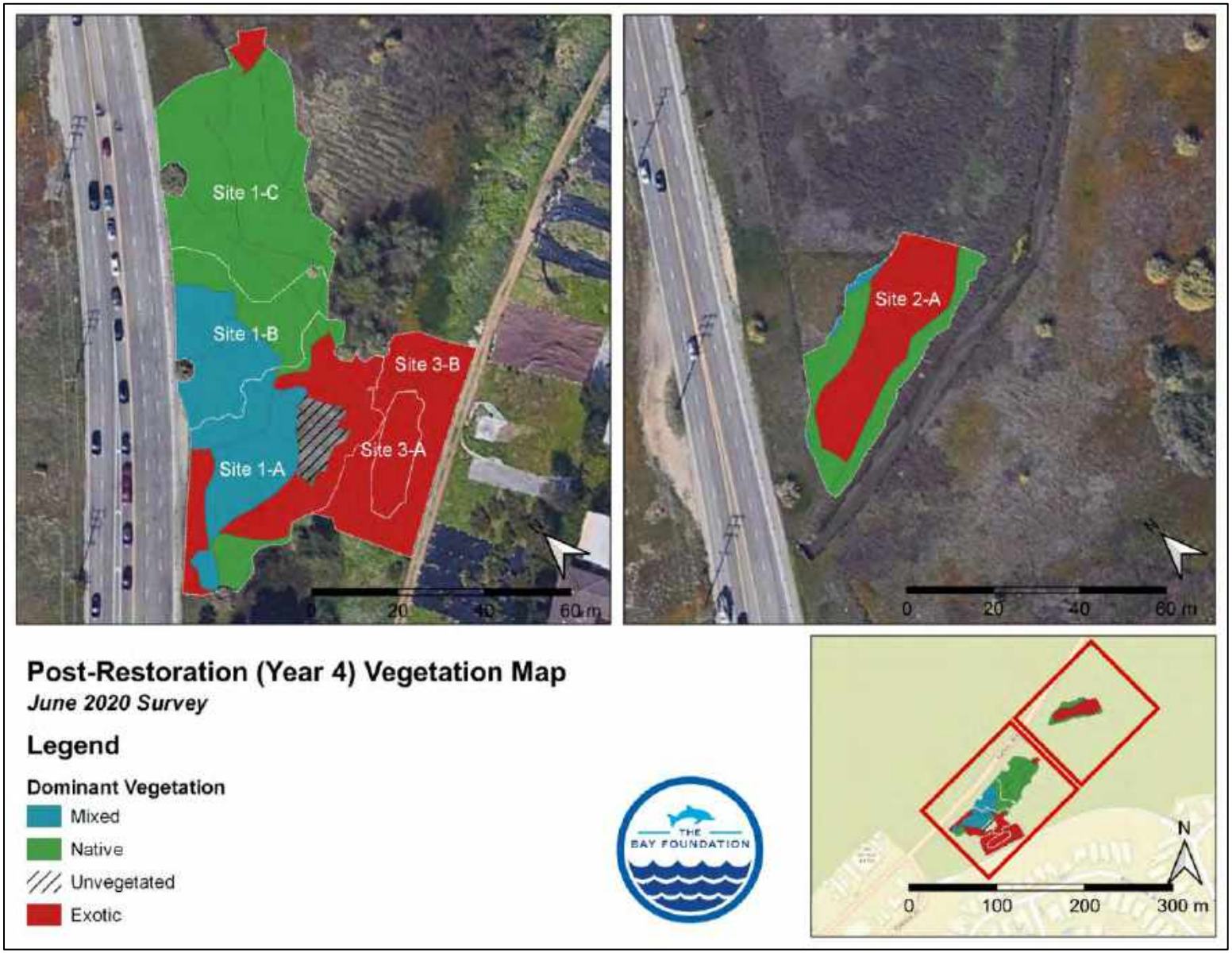


Figure 10h. Map displaying dominant vegetation type within GIS polygons during the Summer 2020 survey on 10-11 June 2020.

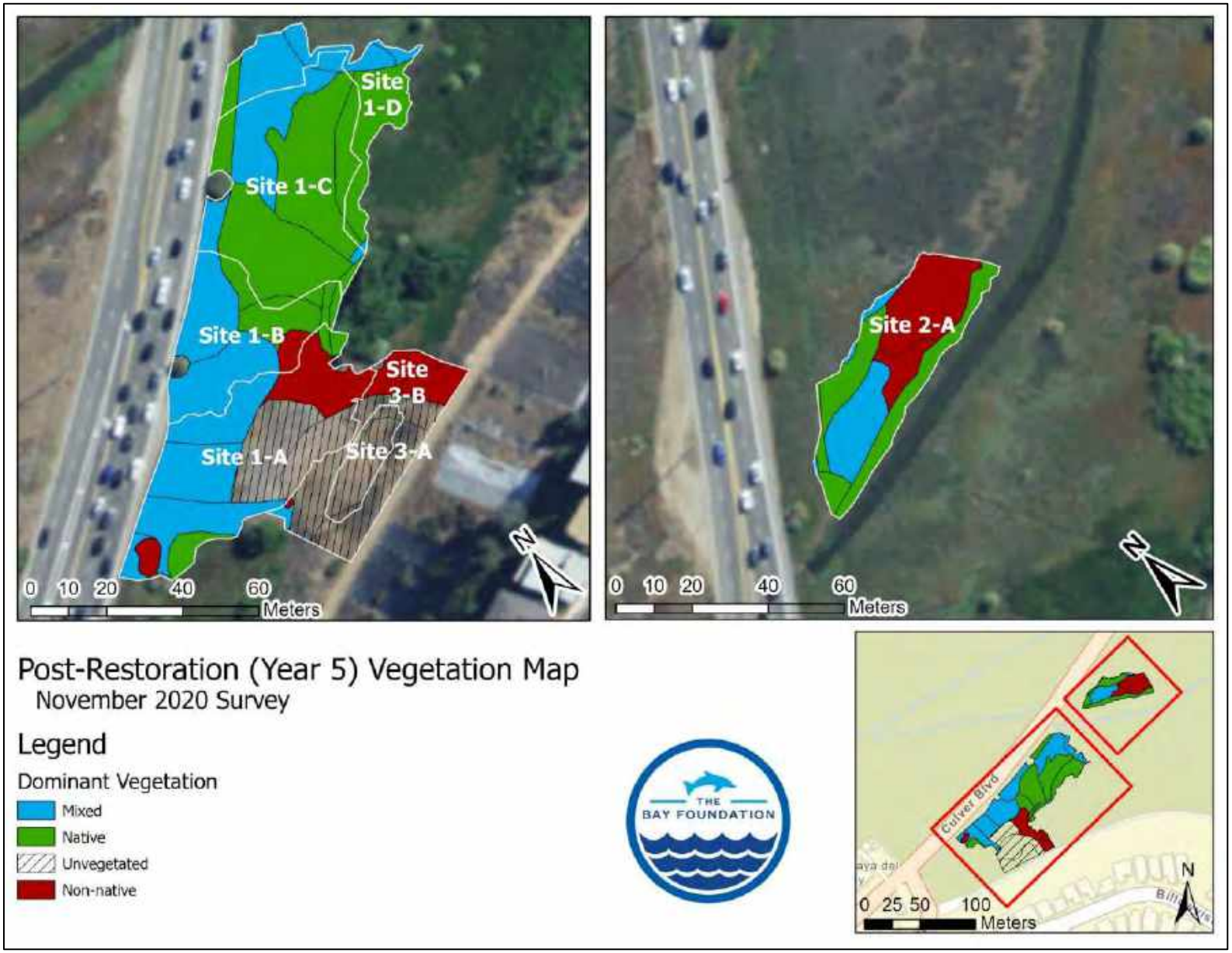


Figure 10i. Map displaying dominant vegetation type within GIS polygons during the Fall 2020 survey on 4 and 6 November 2020.

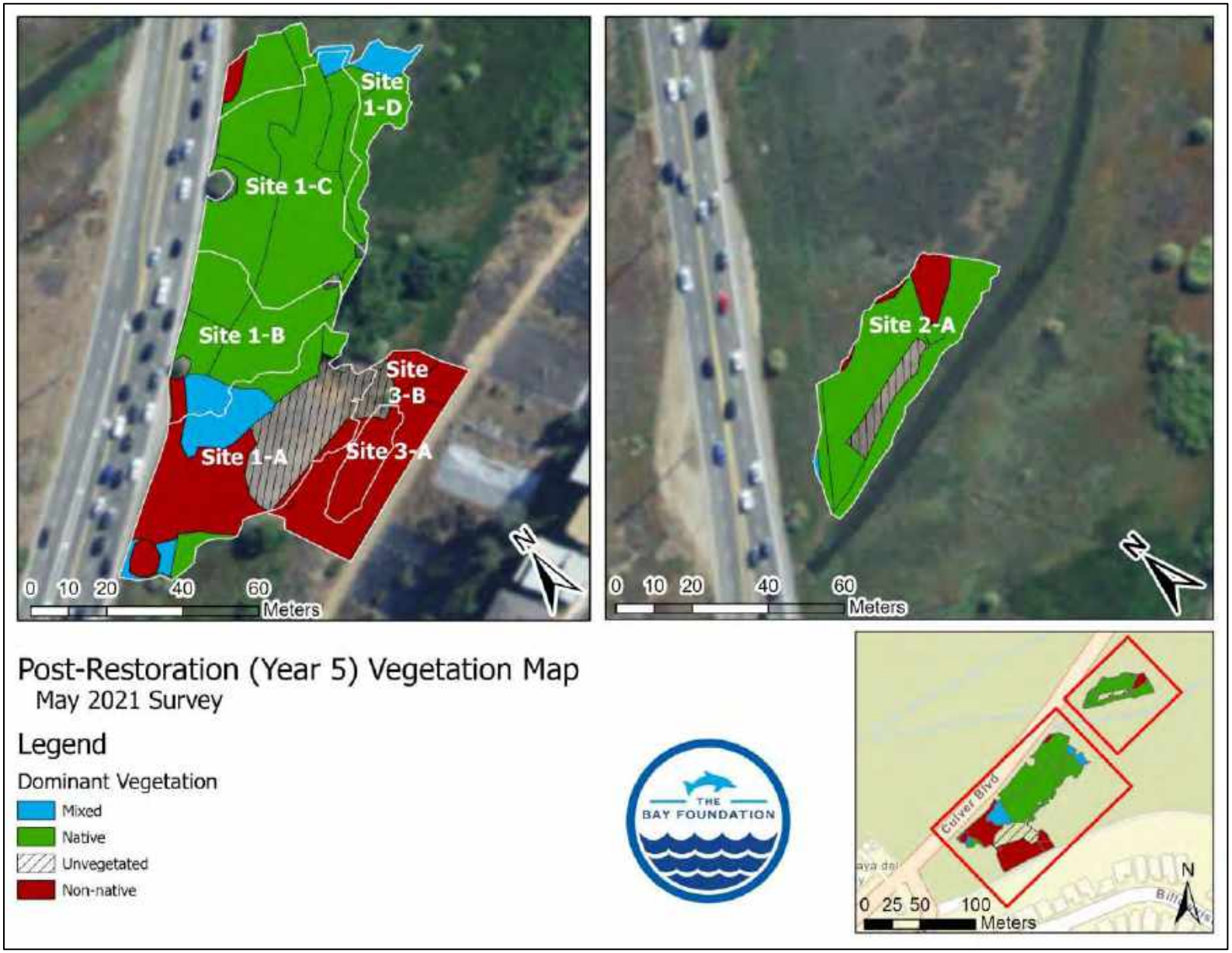


Figure 10j. Map displaying dominant vegetation type within GIS polygons during the Spring 2021 survey on 3 and 11 May 2021.

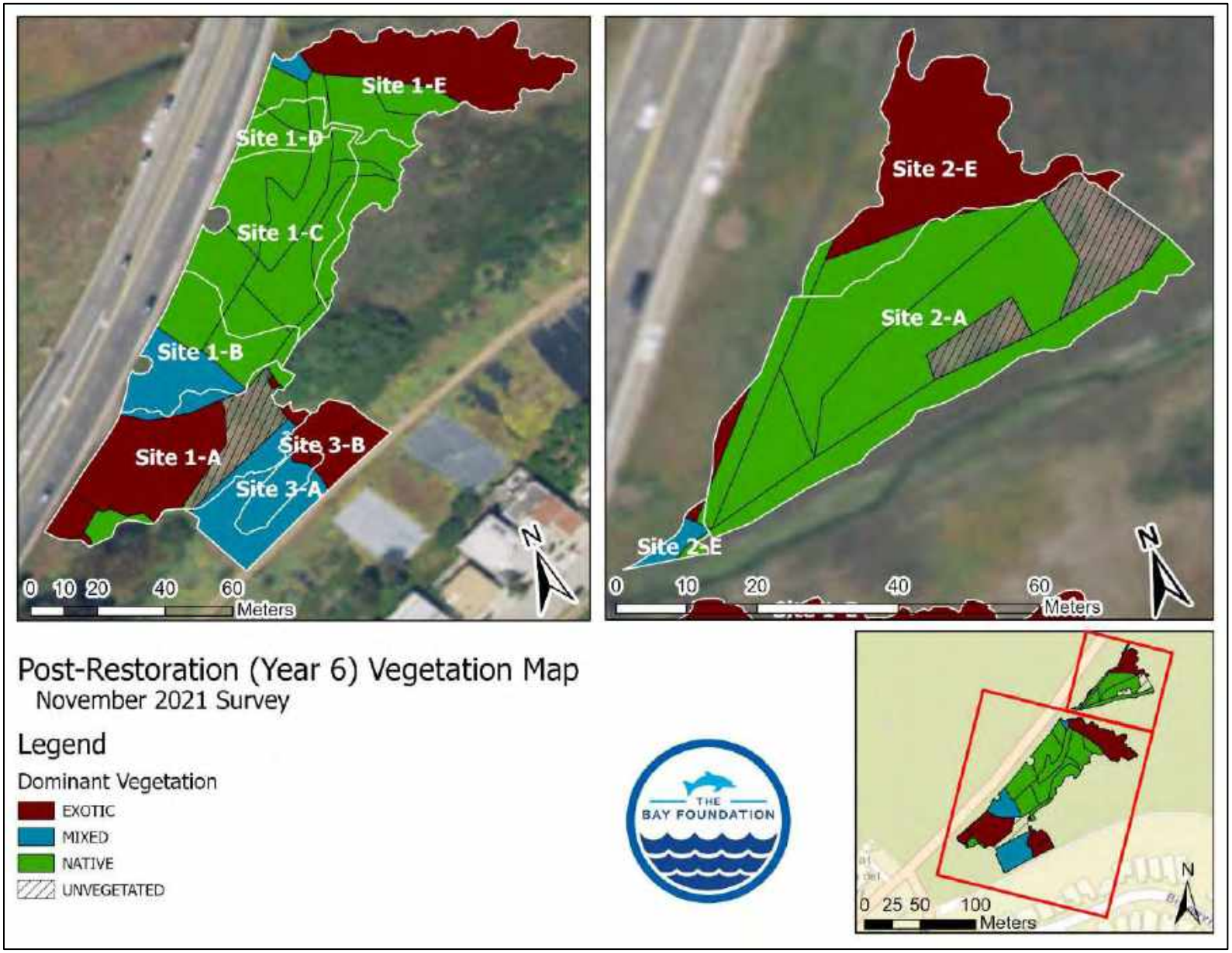


Figure 10k. Map displaying dominant vegetation type within GIS polygons during the Fall 2021 survey on 22 October 2021.

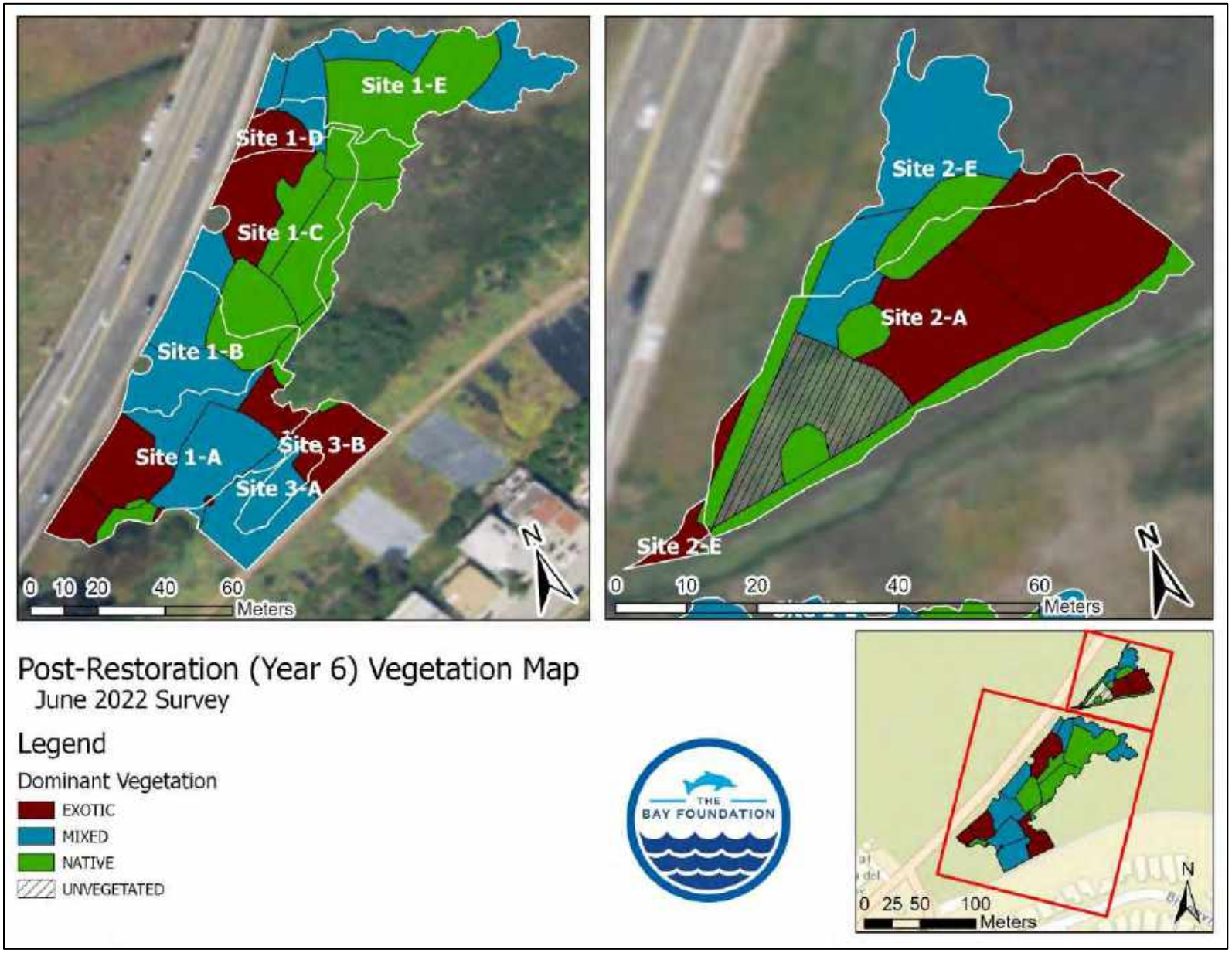


Figure 10l. Map displaying dominant vegetation type within GIS polygons during the Spring 2022 survey on 8 June 2022.

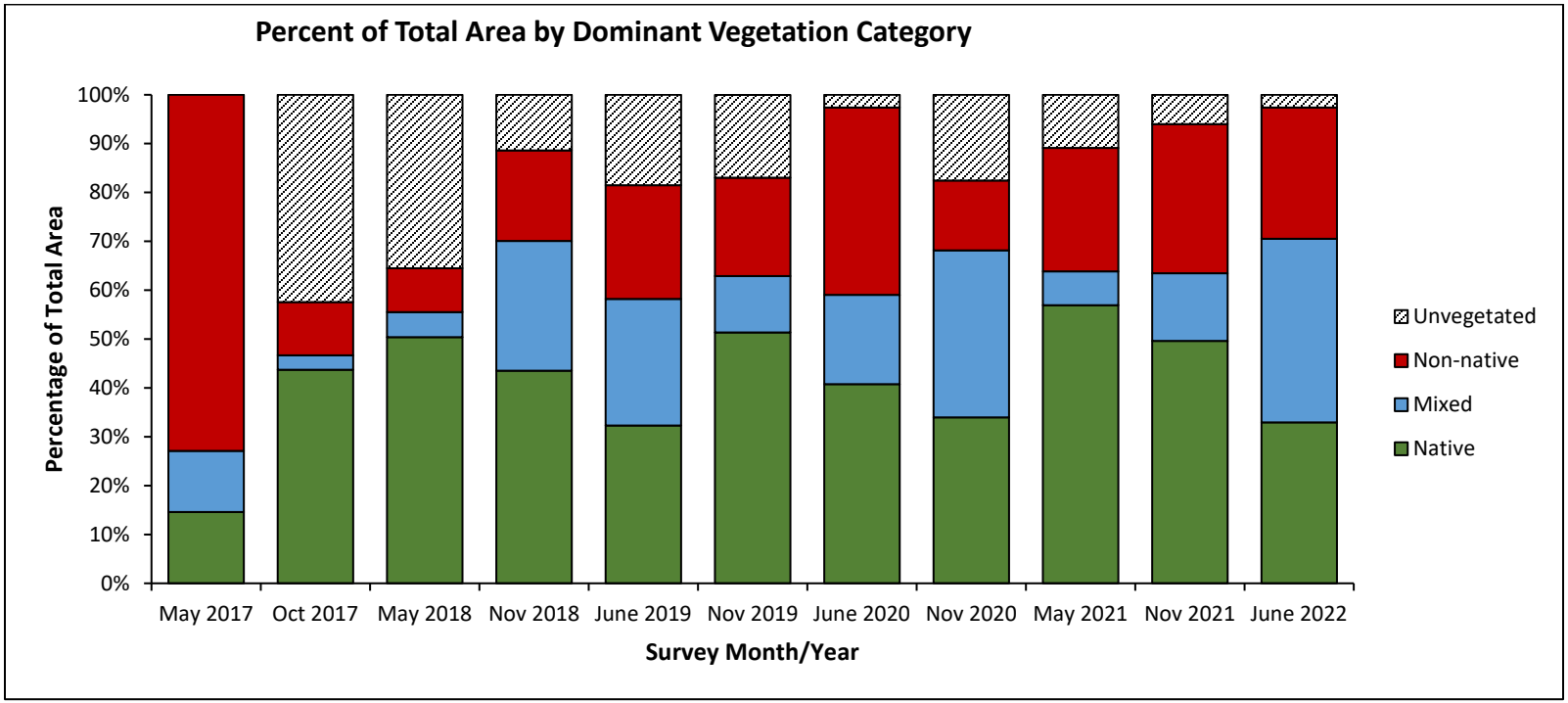


Figure 11. Graph displaying percentage of dominant vegetation type over time based on mapping data.

Vegetation Cover Survey Methods

The primary objective of transect- and quadrat-level cover surveys for this project was to assess the approximate cover of invasive, non-native vegetation over time. Transect- and quadrat-level plant cover data were collected on permanently identified 25-meter transects. Transects were randomly allocated within the "restoration" area and "control" area outside the restoration site. Both "Line-Intercept Transects" and "Cover Class Quadrats" were implemented.

The transect survey methods are described, along with field data sheets, in SOP 3.2 Vegetation Cover Surveys (TBF 2015b). Line-intercept transects documented every species observed directly below the transect tape where the vegetation crossed a minimum of 0.01 m. Line-intercept data were summed by species and divided by the total length of transect to determine percent cover for each transect and habitat. Cover class quadrat surveys were conducted using 1 m^2 PVC quadrats subdivided into 16 sub-quadrats. Ten quadrats were surveyed along each transect. Cover class species data were analyzed using the median of each Daubenmire cover category and averaged to determine percent cover within each transect with variability represented as standard deviation or error (TBF 2015b). Primary analyses were conducted to compare native versus non-native vegetation assemblages. Baseline vegetation data were collected in August 2016. Post-restoration field surveys were conducted in November 2016, immediately following restoration efforts, and again in May 2017, October 2017, May 2018, November 2018, May/June 2019, November 2019, June 2020, November 2020, May 2021, November 2021, and June 2022. Additional transects were added in 2018 and later to capture baseline and post-restoration conditions in different expansion areas of restoration activities (i.e., Site 1-B, 1-D, 1-E 3-A, 3-B). Results are reported as live absolute cover percentages over time to best inform management actions and recommendations for the site. Note that some transect results were previously reported as Control 2, but that site became part of the restoration area in Year 5, so those data are now reported as Site 1-D.

Vegetation Cover Survey Results

Site 1-A transect results indicated a reduction in live non-native vegetation absolute cover from over 90%, pre-restoration, to 3.3% in November 2021, and 6.2% in the most recent June 2022 post-restoration survey (Figure 12). These results indicate a significant reduction in non-native vegetation cover, with minor fluctuation across all six monitoring years along representative transects. Conversely, a fluctuation in native cover from 0% (pre-restoration, baseline) to 14.5% cover in November 2021, and a decrease to 2.5% in the most recent survey (June 2022) was identified at Site 1-A. Native cover at Site 1-A has included expansion of saltgrass and in Year 3, the presence of native annual Canadian horseweed, and patchy alkali weed. In Year 5, targeted revegetation efforts were conducted by seeding and planting container stock of native species in this area. New individuals include presence of deerweed (*Acmispon glaber*), beach evening primrose (*Camissoniopsis cheiranthifolia*), several native grasses (e.g., *Elymus triticoides*), and others. However, bare ground and some weedy annual non-natives continue to be present in this portion of the restoration area from Year 5 and into Year 6.

The substantial reduction in non-native cover at Site 1-A was primarily due to the successful removal of iceplant from the project area and subsequent weeding and maintenance events. The remaining non-native cover was primarily annual "weedy" vegetation species, including: Geraldton carnation weed (*Euphorbia terracina*), non-native brome grasses (*Brome spp.*), wild radish, annual yellow sweetclover, and Bermuda buttercup (*Oxalis pes-caprae*), though other non-native species have been present. The

remaining portions of the restoration area were covered in dead iceplant (acting as mulch) and did not exhibit vegetation growth at the time of the surveys.

Photographs in Figures 18 through 22 illustrate the vegetation transition over time in Site 1-A from a monoculture of iceplant (18, top), to dead iceplant immediately post-restoration (16a, bottom), to a mix of a variety of native and non-native vegetation species (Figures 18 – 24). In Figure 20, saltgrass is discernable in October 2017, and then in May 2018, the most visible species is Geraldton carnation weed. Year 3 post-restoration observations showed minimal non-native species, with the area dominated by the native annual species, Canadian horseweed (Figure 21). Year 4 was predominantly bare ground in the November 2019 survey, and had small patches of Canadian horseweed in the June 2020 survey (Figure 22). The Year 5 November 2020 survey was conducted immediately prior to restoration activities, including weeding and planting of native container stock vegetation. Figure 23, left shows the November 2020 survey, with bare ground dominant and small patches of natives and non-natives. Figure 23, right, shows the May 2021 survey approximately six months after restoration activities and is dominated by annual brome grasses, but with patches of native plants that were installed as container stock at the end of 2020. Figure 24, left shows the November 2021 survey, with small patches of saltgrass and brome grasses. Figure 24, right shows the June 2022 survey, with a continued dominance of annual brome grasses and patches of native plants.

Similarly, Site 2-A transect results indicated a shift from over 80% non-native cover, pre-restoration, to 0.0% in November 2021 and 14.6% in June 2022. Prior to the November 2021 survey, iceplant removal continued to the north (Site 2-E). Native cover in this area experienced patchiness and seasonal variability, with a fluctuation between 0% (November 2016) to 46.9% in November 2021 and 28.5% in June 2022 (Figure 12). Non-native cover in the form of weedy annual species increased in the June 2021 survey following iceplant removal the previous fall.

Restoration Site 1-B was newly restored in Year 3; thus, it has fewer survey days. This area identified 40.7% non-native vegetation cover in the baseline survey with 57.9% native cover. Native cover was predominantly saltgrass, and non-native cover was predominantly iceplant. The post-restoration surveys showed a dramatic increase in native vegetation dominated by saltgrass and decrease in non-native vegetation (Figure 13). During Year 6, non-native vegetation cover ranged from 0.3% in November 2021 to 3.8% in June 2022 and native vegetation cover ranged from 79.3% in November 2021 to 63.2% in the most recent survey (June 2022). Site 1-B had consistently high native vegetation cover since restoration activities occurred, dominated by saltgrass, but including several other natives such as small patches of alkali heath and alkali weed. The non-natives present in this area included patches of common sowthistle (*Sonchus oleraceus*), individual brome grasses (Figure 28), and wild oat (*Avena spp*.). Restoration Site 1-C was newly restored in Year 4 and has been dominated by native saltgrass since restoration activities occurred.

Restoration Site 1-D was newly restored during Year 5 (surveys beginning November 2020). Pre-restoration baseline conditions fluctuated by season and year, with a high non-native cover of 92.1% in May 2017, and a high native cover of 62.6% in November 2019. In Year 6, native cover remained high at 95.9% in November 2021, but decreased to 39.5% in the June 2022 survey. Conversely, non-native cover remained low after restoration activities, with 0.7% cover during the November 2021 survey and

increased to 58.6% in June 2022. Common sowthistle and prickly lettuce dominated the non-native vegetation cover in the disturbed soil, an area that runs parallel to Culver Blvd. This area has been targeted for maintenance in Year 7 to remove the sowthistle and prickly lettuce.

Vegetation transect surveys began for Transect 1-E-1 in June 2020 (Baseline) and for Transect 1-E-2 in November 2021 (Baseline). Restoration Site 1-E was newly restored in Year 6. Transect 1-E-1 identified native vegetation cover at 25.7% and non-native cover at 64.4% in the baseline survey. In Year 6, native cover increased to 94.0% in November 2021 and 85.9% in June 2022, showing a substantial increase in native cover from the baseline survey. Native saltgrass has dominated the area since restoration. The baseline survey of Transect 1-E-2 in November 2021 identified native cover of 35.7% and non-native cover of 63.4%. Restoration efforts in Year 6 focused on this area, and the most recent survey in June 2022 showed an increase of native vegetation cover to 59.3% and non-native cover of 16.4.%.

Baseline surveys for Sites 3-A and 3-B were conducted in November 2020, shortly before restoration implementation. Restoration Sites 3-A and 3-B were newly revegetated during Year 5. The baseline identified native vegetation cover at 1.8%, with live non-native cover at 2.8%. In Year 6, native vegetation cover was recorded at 15.5% in November 2021 and increased to 39.2% in the recent June 2022 survey. Native shrubs in the area have continued to expand, including California sagebrush, seacliff buckwheat, branching phacelia, and black sage (*Salvia mellifera*). Non-native vegetation cover has decreased, with 8.4% coverage in November 2021 and 2.0% in June 2022. Non-native plants are almost entirely comprised of annual species and include wild radish (*Raphanus sativus*) and brome grasses.

Control results (transects not altered during restorations) indicated some stability in the predominantly native areas. Results from four control areas are presented in Figures 16 and 17. In Year 6, two new control areas, one with intermixed non-native and native cover (Control 5) and another with predominantly non-native cover (Control 6), were added to track fluctuations of non-native species over time as compared to the restoration areas. Control Sites 1 and 3 were all predominantly native, with a native cover range of 73.8-100% in Control 1 and 60.5-93.9% in Control 3, across all survey dates and years (Figure 16). Additionally, the control results identified varying resistance to invasion, with a range of 0-21.4% non-native cover across Control 1 and 3 transects. These control transect results are indicative of the variability in percent cover within predominately native areas located outside of the restoration project footprint area, but within the Reserve during the time period surveyed. The newly established Control Site 5 represents an intermixed area of non-native and native cover, with native cover ranging from 46.2-54.8% and non-native cover ranging from 42.5-51.3% (Figure 17). The native species in the area are mainly patches of saltgrass and salt heliotrope (*Heliotropium curassavicum*). The recently established Control 6 Site is an area of low native and high non-native vegetation cover, primary consisting of iceplant. Native cover started at 11.1% in the baseline survey and decreased to 2.5% in the most recent June 2022 survey. Non-native vegetation cover fluctuated from 88.9% in the baseline survey to 92.6% in the June 2022 survey (Figure 17).

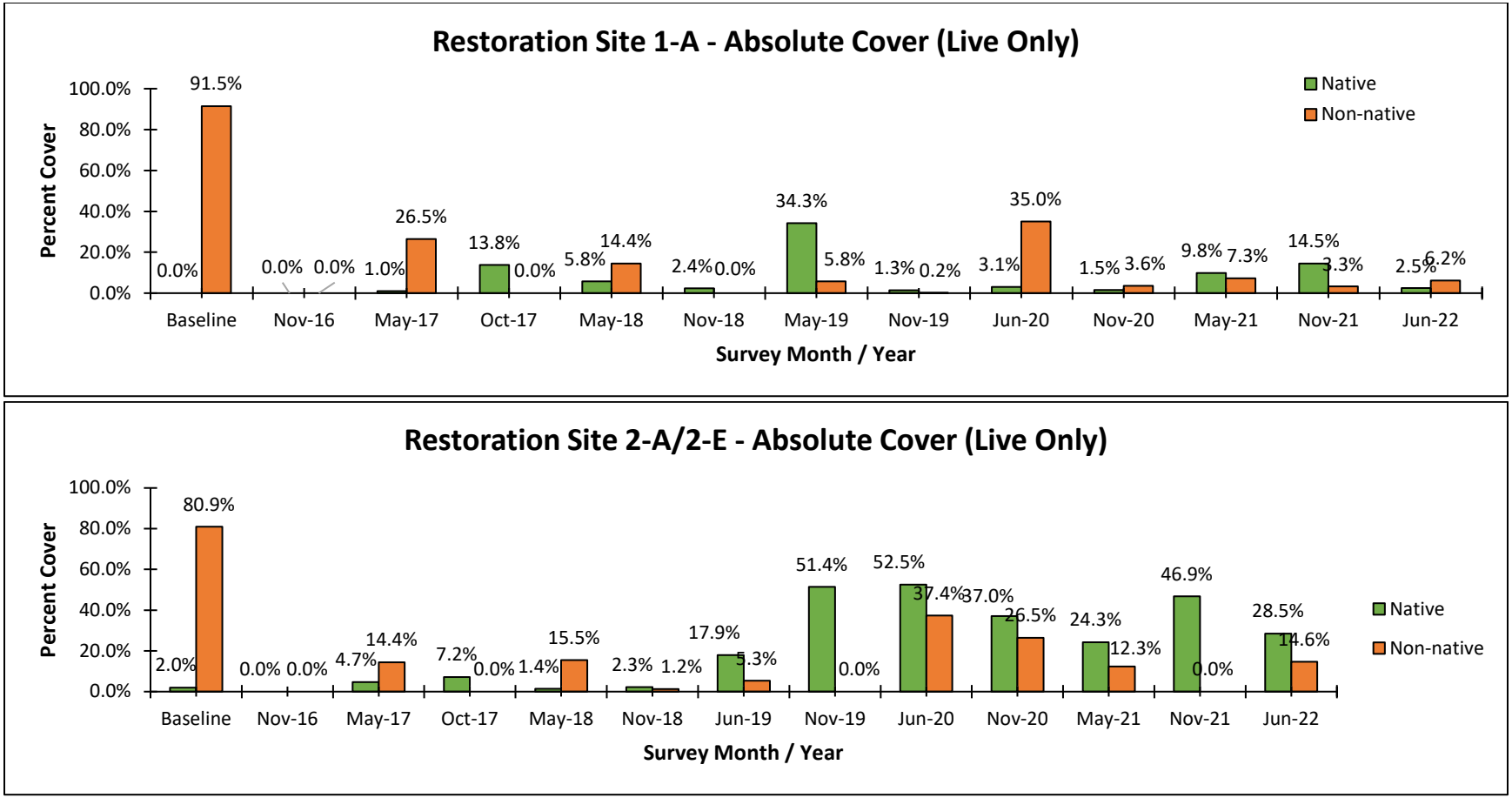


Figure 12. Vegetation data cover results from Site 1-A (top) and Site 2-A (bottom) absolute vegetation cover (live only).

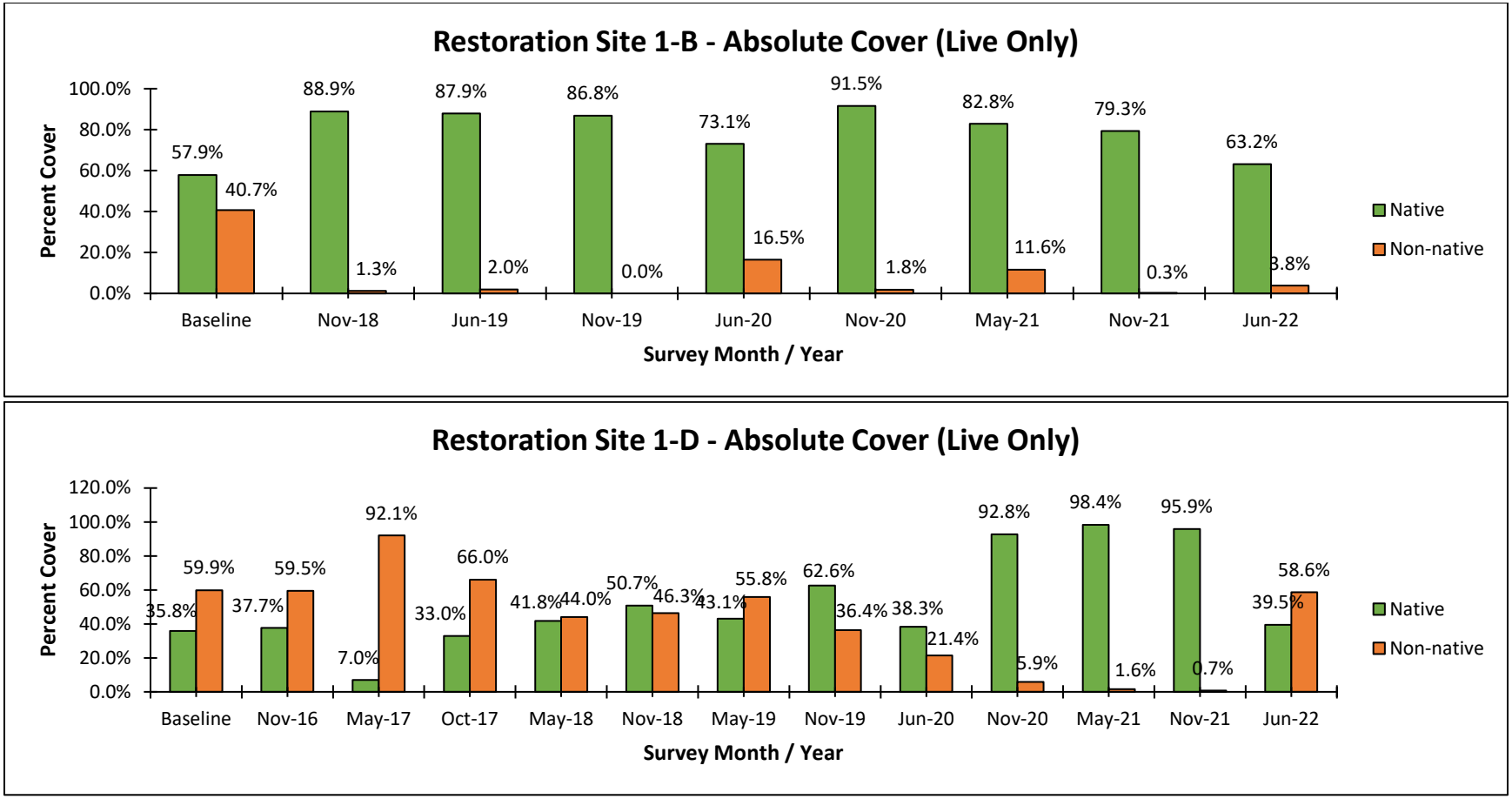


Figure 13. Vegetation data cover results from Site 1-B (top; restored in Year 3, June 2018) and newly restored Site 1-D (bottom). Site 1-D was reported as Control 2 in previous reports prior to restoration actions.

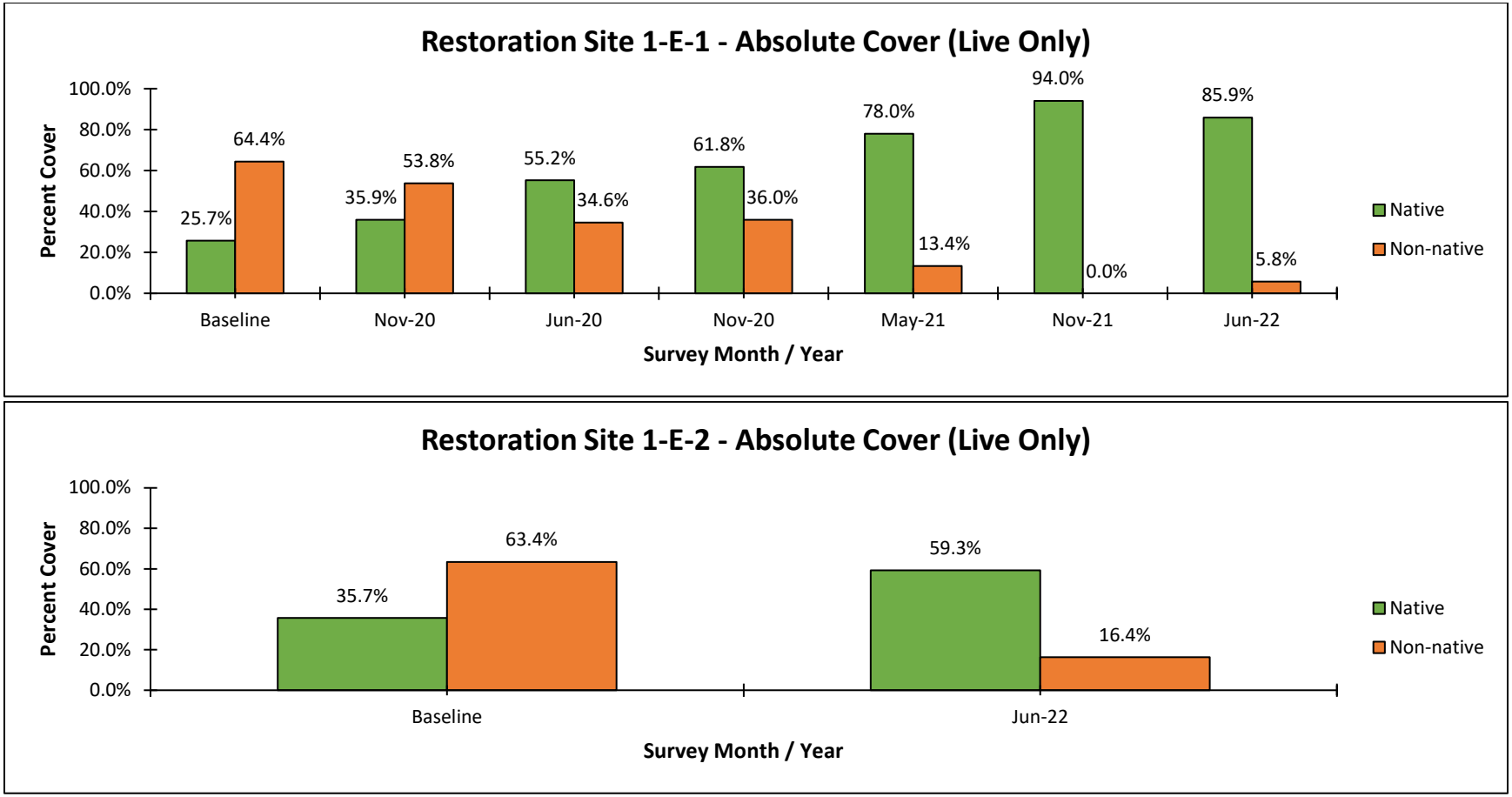


Figure 14. Vegetation data cover results from Site 1-E-1 (top) and newly restored Site 1-E-2 (bottom; restored following November 2021 monitoring).

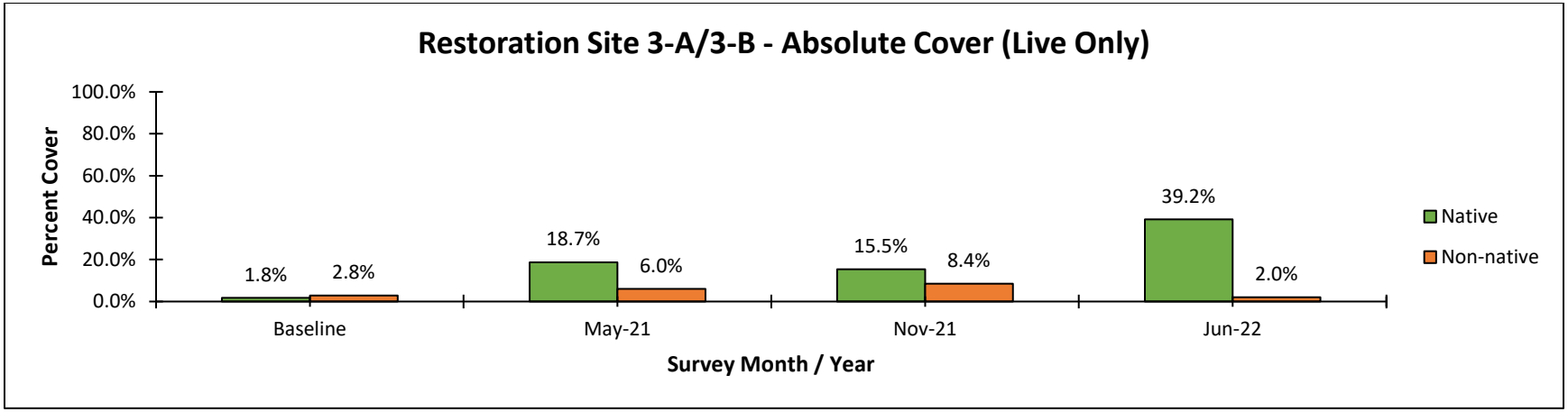


Figure 15. Vegetation data cover results from Site 3A and 3B (live only). This area was revegetated in Fall 2020 prior to November 2020 monitoring.

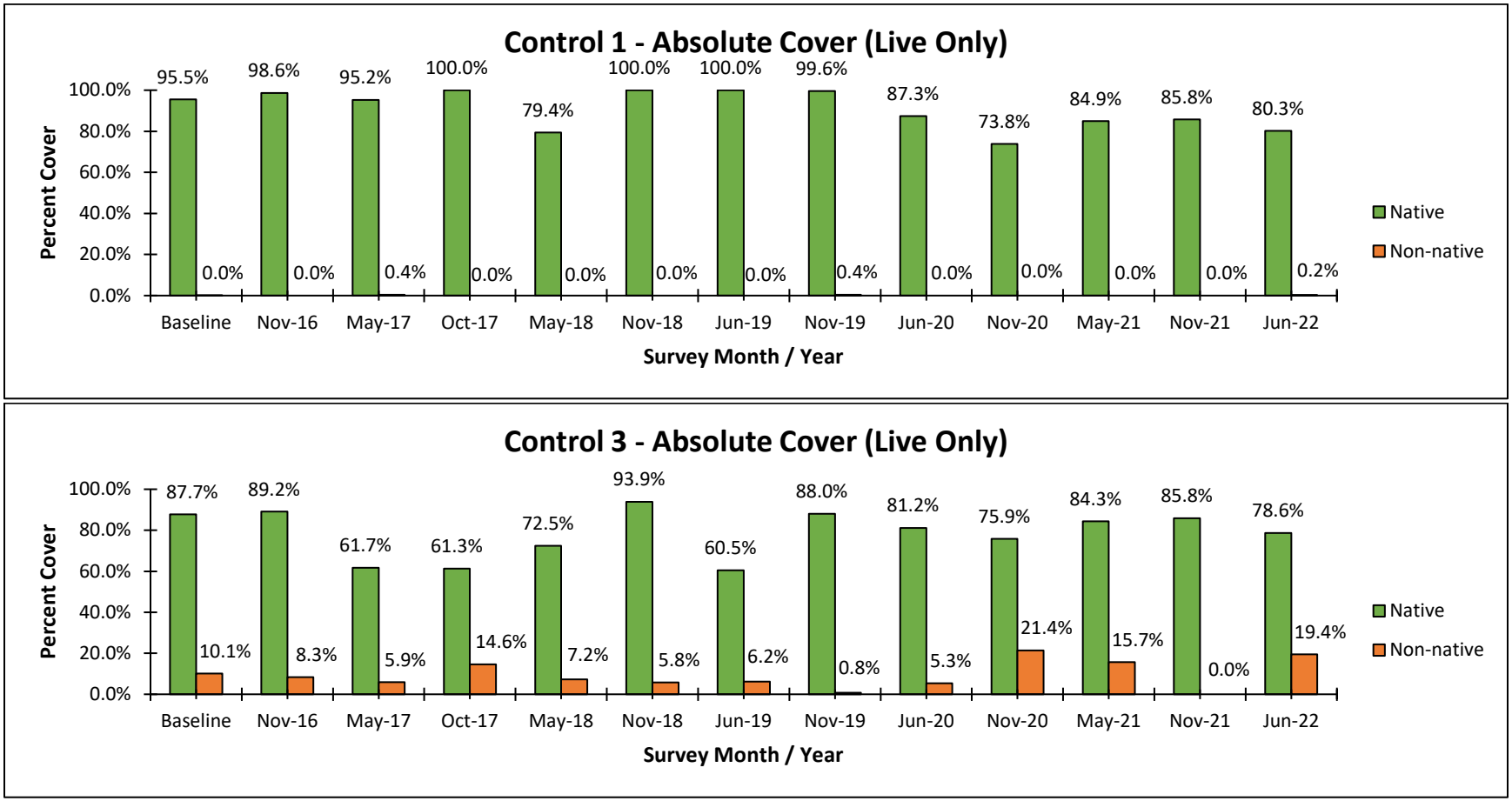


Figure 16. Vegetation data cover results from Control Site 1 (top) and Control Site 3 (bottom) absolute vegetation cover (live only).

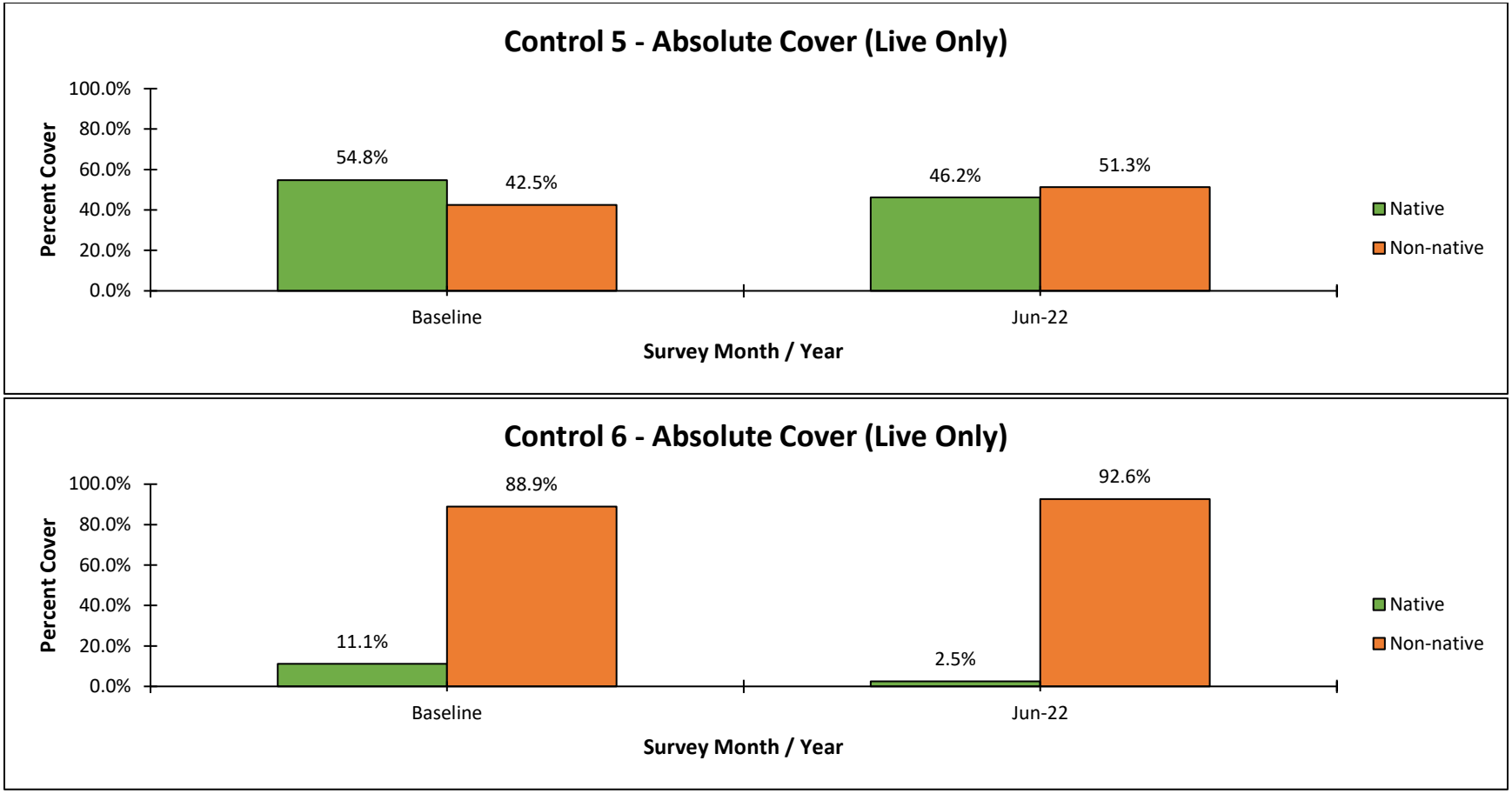


Figure 17. Vegetation data cover results from Control Sites 5 (top) and 6 (bottom), both controls were established in November 2021.

Figure 18. Photographs of Transect 5 pre-restoration on 23 August 2016 (A, top) and immediately post-restoration on 29 November 2016 (B, bottom).

Figure 19. Photographs of Transect 5 post-restoration on 1 May 2017 (C).

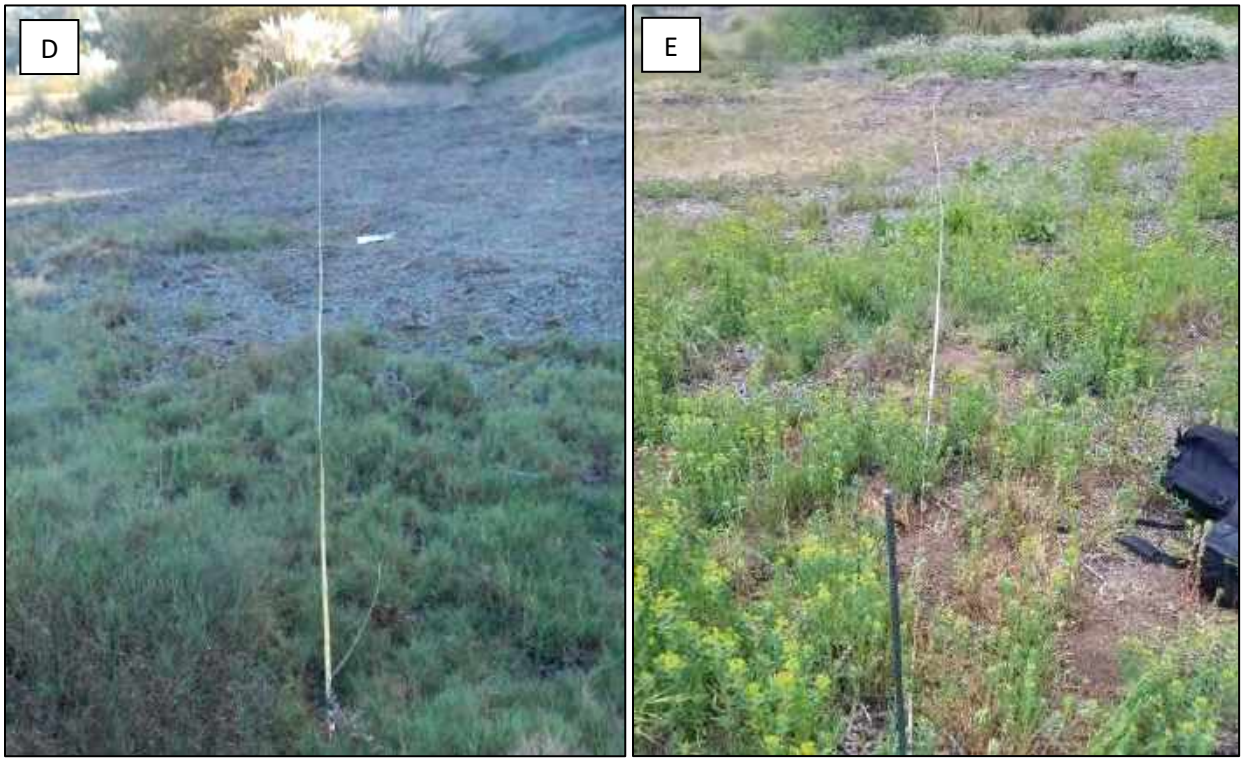


Figure 20. Photographs of Transect 5, Year 2 post-restoration, on 7 October 2017 (D), and 1 May 2018 (E). Note: photograph (D) was taken at a slightly different starting location, hence the saltgrass patch present in (D) and not after. Subsequent photo start point locations (E and after) were corrected.

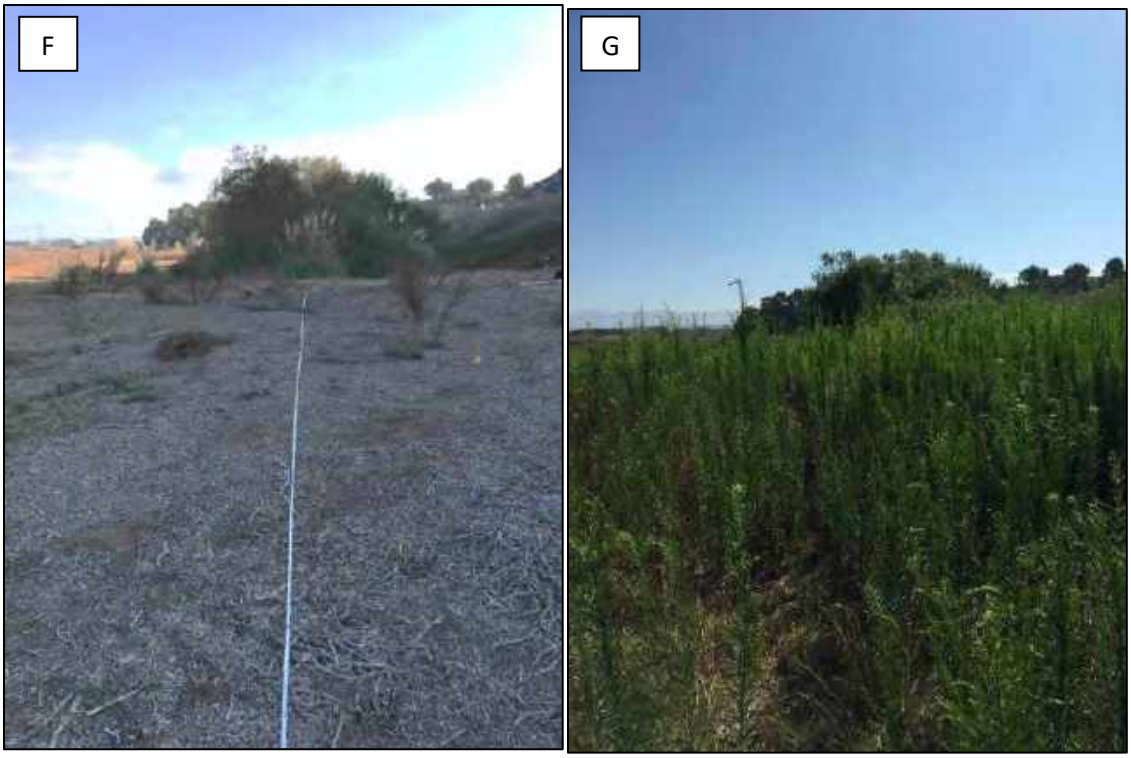


Figure 21. Photographs of Transect 5, Year 3, post-restoration on 28 November 2018 (F), and 24 July 2019 (G).

Figure 22. Photograph of Transect 5, Year 4, post-restoration on 16 July 2020 (H).

Figure 23. Photographs of Transect 5, Year 5, post-restoration on 12 November 2020 (I), 18 May 2021 (J).

Figure 24. Photographs of Transect 5, Year 6, post-restoration on 17 November 2021 (K), 1 June 2022 (L).

Figure 25. Photograph of beginning of Transect 7 at baseline conditions (pre-restoration) on 9 August 2018 (A) and within weeks of post-restoration on 28 November 2018 (B).

Figure 26. Photograph of Transect 7 post-restoration on 5 June 2019 (C) and 21 July 2020 (D).

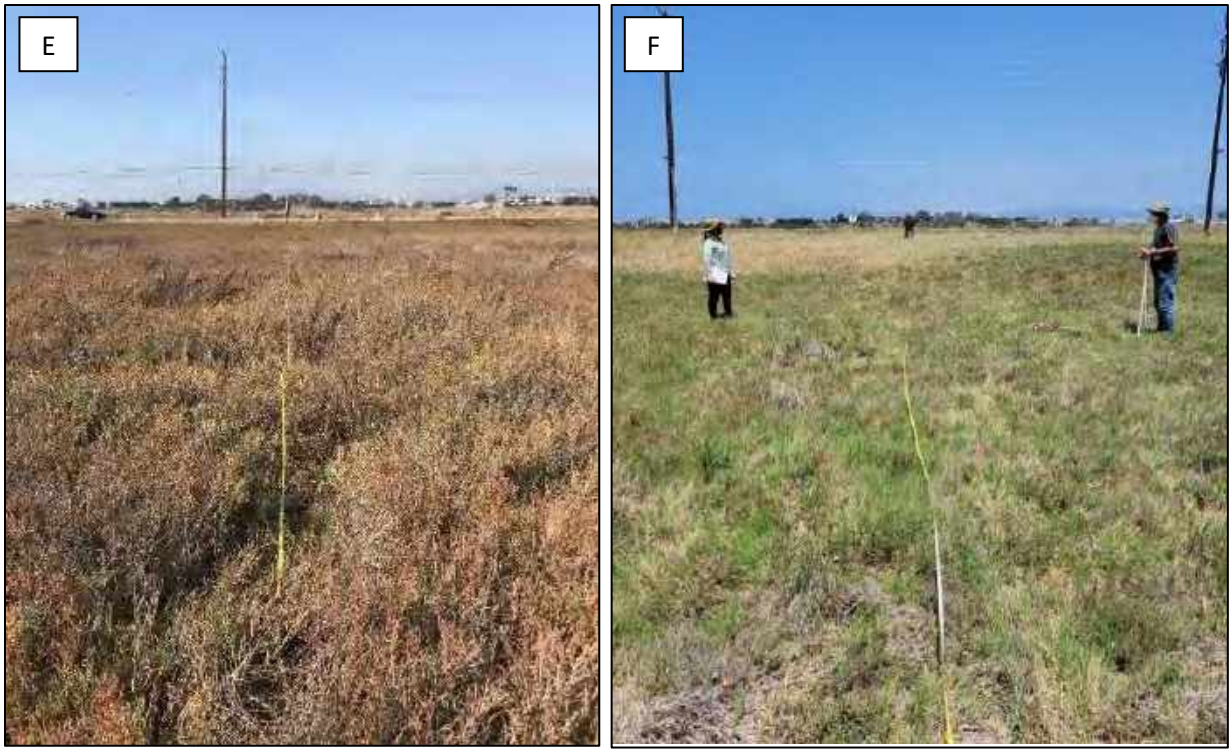


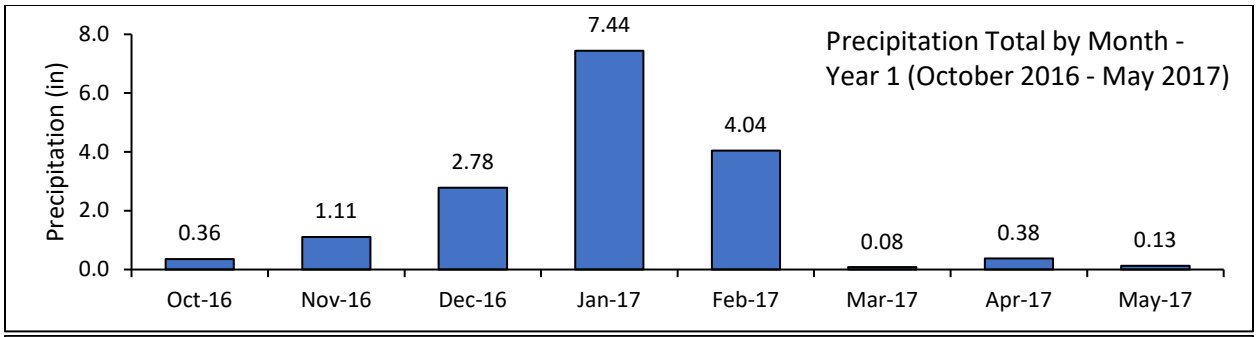
Figure 27. Photographs of Transect 7, Year 5, post-restoration on 12 November 2020 (E), and 18 May 2021 (F). Note: Photo (E) was taken at a slightly different starting location and the location was subsequently corrected for photo (F).

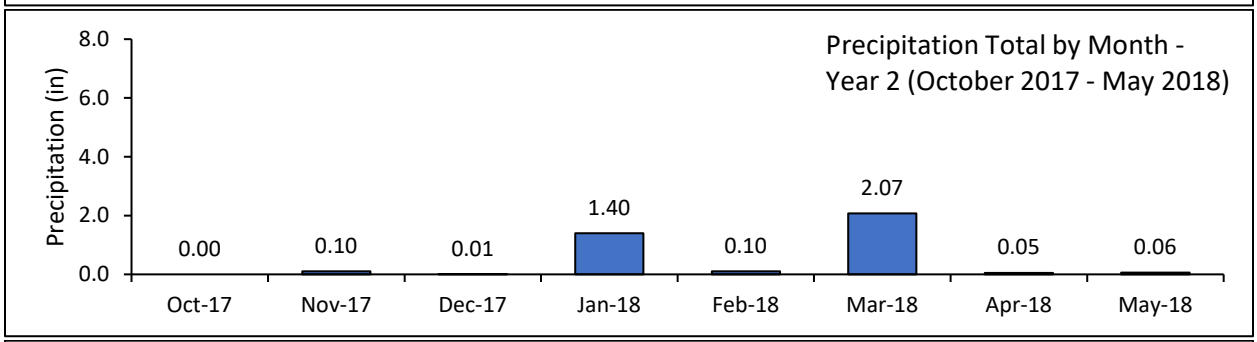
Figure 28. Photographs of Transect 7, Year 6, post-restoration on 17 November 2021 (G), and 3 June 2022 (H).

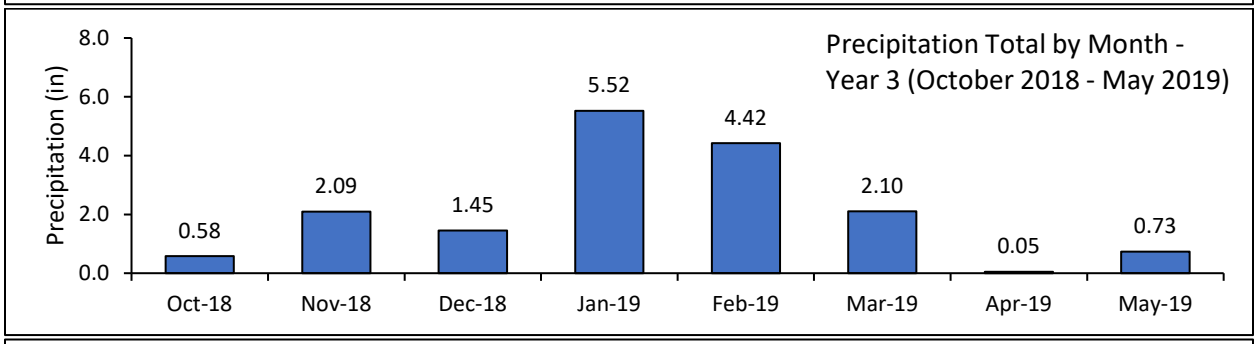
Figure 29. Photo of adjacent non-restored area of project site on 17 November 2021 showing predominantly iceplant with intermixed saltgrass and other species.

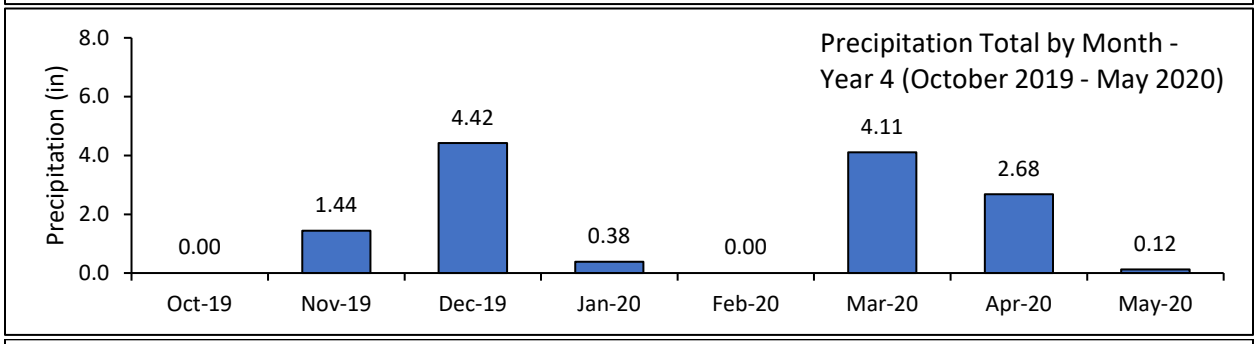
Precipitation

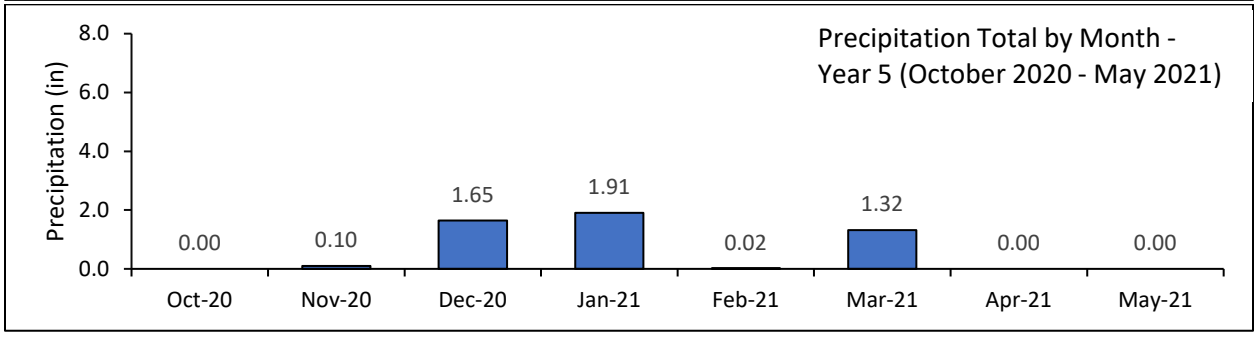
Daily precipitation data were downloaded from AccuWeather Premium and NOAA (National Centers for Environmental Information) Climate Data Online, recorded at the LAX rain gauge. The total rainfall for the wet weather months (October through May of the following year) was 16.32 inches during Year 1, 3.79 inches in Year 2, 16.94 inches in Year 3, 13.03 inches in Year 4, 5.00 inches in Year 5, and 10.16 inches in Year 6 as measured by the Los Angeles International Airport (LAX) rain gauge. Year 2 and Year 5 had noticeably less precipitation than Years 1, 3, and 4, whereas Year 6 had a relatively moderate amount. The majority of rainfall in Year 6 occurred in the month of December 2021. Precipitation is particularly important to monitor during revegetation efforts and can be meaningful when analyzing vegetation monitoring data. Figure 30 shows the total rainfall for wet weather months throughout the duration of the project.


Precipitation Total by Month -
Year 1 (October 2016 - May 2017)
Precipitation (in)
8.0
6.0
4.0
2.0
0.0
0.36
1.11
2.78
7.44
4.04
0.08
0.38
0.13
Oct-16
Nov-16
Dec-16
Jan-17
Feb-17
Mar-17
Apr-17
May-17


Precipitation Total by Month -
Year 2 (October 2017 - May 2018)
Precipitation (in)
8.0
6.0
4.0
2.0
0.0
0.00
0.10
0.01
1.40
0.10
2.07
0.05
0.06
Oct-17
Nov-17
Dec-17
Jan-18
Feb-18
Mar-18
Apr-18
May-18


Precipitation Total by Month -
Year 3 (October 2018 - May 2019)
Precipitation (in)
8.0
6.0
4.0
2.0
0.0
0.58
2.09
1.45
5.52
4.42
2.10
0.05
0.73
Oct-18
Nov-18
Dec-18
Jan-19
Feb-19
Mar-19
Apr-19
May-19


Precipitation Total by Month -
Year 4 (October 2019 - May 2020)
Precipitation (in)
8.0
6.0
4.0
2.0
0.0
0.00
1.44
4.42
0.38
0.00
4.11
2.68
0.12
Oct-19
Nov-19
Dec-19
Jan-20
Feb-20
Mar-20
Apr-20
May-20


Precipitation Total by Month -
Year 5 (October 2020 - May 2021)
Precipitation (in)
8.0
6.0
4.0
2.0
0.0
0.00
0.10
1.65
1.91
0.02
1.32
0.00
0.00
Oct-20
Nov-20
Dec-20
Jan-21
Feb-21
Mar-21
Apr-21
May-21

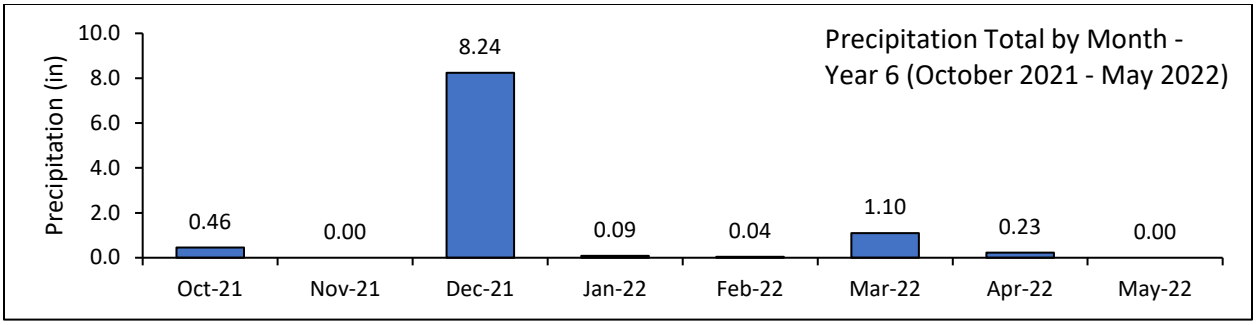


Figure 30. Monthly precipitation totals (inches) for wet weather months (October – May) (data: NOAA).

Avifauna and Other Wildlife

No wildlife was harmed as part of this restoration project. There was no mortality under the tarps, and many species identified on or around the restoration area. It is important to note that the surveys conducted were not standardized for time or effort and are thus just displayed as presence data. The results should not be interpreted as full species lists of wildlife inhabiting the area; rather, they are just indicative of some of the species using the site on monitoring days. Species lists are not intended to be analyzed for statistical relevance.

Avifauna and Wildlife Survey Methods

The presence and distribution of avifauna within an ecosystem is often used as an index of habitat quality due to their diet and vulnerability to environmental conditions (Conway 2008). Avifauna data are useful to characterize representative avian assemblages and spatial distributions within a particular area. There are two primary purposes of avifauna and wildlife surveys for this project. First, it was to confirm a lack of breeding or nesting behavior for avifauna prior to the commencement of restoration activities to ensure no disturbance. Second, it was to provide a general understanding of the bird and wildlife community in the restoration area before and after restoration.

Bird survey methods are described in detail, along with field data sheets, in SOP 5.1 Bird Abundance-Activity (TBF 2015d). Bird surveys were performed by an ornithologist and entailed both observational visual and auditory bird surveys on 30 August 2016, 15 December 2016, 1 May 2017, 1 December 2017, 13 July 2018, 12 February 2019, 11 April 2019, 30 July 2019, and 31 October 2019. Observational bird and wildlife data were also collected during the implementation of other survey protocols and during restoration events; seven supplemental surveys were conducted during Year 2. Additionally, site checks throughout Years 3, 4, and 5 noted birds and wildlife on site when observed.

Avifauna and Wildlife Survey Results

No wildlife mortality was observed under the tarps during or after restoration. In fact, several reptiles (i.e., Western fence lizards, an alligator lizard, and a juvenile gopher snake) and several amphibians (i.e., Pacific tree frogs) were identified and moved during restoration events because they were on, under, or immediately adjacent to the tarps. They were moved to native salt marsh habitats immediately adjacent to the restoration area to avoid disturbance during events.

Avifauna were identified through ornithological surveys conducted by Cooper Ecological Monitoring, Inc., and other trained surveyors using Cooper methods. Birds were also identified as part of wildlife

observation and monitoring days conducted by TBF and FBW. Table 4 includes a list of species identified as part of these monitoring surveys within the restoration area (first two columns). The rest of the columns to the right-hand side summarize specialized bird survey results. It should be noted that this table is not intended as a comprehensive or exhaustive list of species using the restoration area or adjacent habitats; several other species were visually observed by community members during restoration events. These results are intended to provide an overall understanding of some of the birds and wildlife using the restoration area and are not intended for statistical analyses or to infer project success. Table 4 is intended as a checklist of birds by survey date. No Belding's savannah sparrows were identified during the pre-restoration survey, and the ornithologist concluded that use of the pre-restoration area by this species during the project was very unlikely to occur.

Table 4 displays bird presence survey results through July 2022. Many of the birds on the specialized ornithological surveys were identified immediately adjacent to the project area, rather than within the restoration footprint. This trend was exhibited during both the pre- and post-restoration surveys. The pre-restoration data column also includes species seen during restoration events within the project footprint area. Several raptor species were observed hunting or foraging adjacent to or above the post-restoration project site, such as red-tailed hawk, red shouldered hawk, Cooper's hawk, and American kestrel. One osprey was observed hunting (flying) above the tide channel adjacent to Site 2-A. During the bird survey on 31 October 2019, multiple individuals of several species were seen, including black phoebe, Say's phoebe, common yellowthroat, song sparrow, and great egret. Additionally, snowy egrets were commonly identified in the tide channel adjacent to Site 2-A, and occasional great blue herons were seen foraging in the western portion of the restoration area (Site 1-C).

During restoration events and post-monitoring surveys, a number of wildlife were seen and recorded such as butterflies and moths and other invertebrate pollinators (Table 5, Figure 31). Post-restoration wildlife identified included a variety of herpetofauna, mammals, and invertebrates. Western fence lizards, side-blotched lizards, and Pacific tree frogs were frequently observed, and alligator lizards were seen occasionally. A southern California legless lizard was found in the restoration site on 11 November 2020 in an area on the hillside where container stock was being planted that had been previously covered in iceplant. Butterflies, moths, and other notable invertebrates were also recorded and included wandering skipper, cabbage white butterflies, common buckeye butterflies, and others. California ground squirrel and Botta's pocket gopher burrows were also present throughout the restoration and adjacent areas and seen visually, while cottontail rabbits were frequently seen along the adjacent bluffs. Table 5 displays wildlife presence results. Similarly to the birds, this table is not intended as a comprehensive or exhaustive list of species using the restoration area or adjacent habitats. These results are intended to provide an overall understanding of some of the wildlife using the restoration area and are not intended for statistical analyses or to infer project success.

Figure 31. Photographs of a Say's phoebe (top left), a white-tailed kite (top right), and a gopher snake (bottom) in and adjacent to the restoration area.

Table 4. Bird species identified in and around the restoration project area.

** Note: Pre-restoration (and during) survey efforts and post-restoration survey efforts are not equivalent and are not intended to be compared quantitatively or to infer project success.*
*** Note: Cooper Ecological ornithological surveys and observations were identified within approximately 50 feet of the project boundary.*

Common Name	Pre-restoration (and during) *	Post-restoration *	Cooper (5/1/17) **	Cooper (12/1/17) **	Cooper (7/13/18) **	Cooper & Associates (2/12/19) **	Cooper & Associates (4/11/19) **	FBW – Cooper (07/30/19) **	FBW – Cooper (10/31/19) **
Allen's hummingbird		X	X		X	X	X	X	
American crow		X			X		X		
American kestrel		X		X	X				X
Anna's hummingbird		X			X	X	X		
Black phoebe	X	X		X	X	X		X	X
Black-crowned night-heron							X		
Blue-gray gnatcatcher		X							
Brown-headed cowbird							X		
Bushtit		X	X			X	X		X
California towhee		X	X	X					
Cassin's kingbird				X					
Cliff swallow		X							
Common raven			X						
Common yellowthroat		X	X	X	X	X	X	X	X
Cooper's hawk		X			X				X
Gadwall							X		
Great blue heron		X							
Great egret		X							X
Great horned owl							X		
Green-winged teal						X			
Hooded oriole							X	X	

Common Name	Pre-restoration (and during) *	Post-restoration *	Cooper (5/1/17) **	Cooper (12/1/17) **	Cooper (7/13/18) **	Cooper & Associates (2/12/19) **	Cooper & Associates (4/11/19) **	FBW – Cooper (07/30/19) **	FBW – Cooper (10/31/19) **
House finch		X	X	X	X	X	X	X	
House sparrow		X					X		
House wren		X	X						X
Least sandpiper						X			
Lesser goldfinch		X			X		X	X	
Lincoln's sparrow						X			X
Killdeer		X							
Mallard		X				X	X		
Marsh wren				X		X			X
Mourning dove		X	X		X	X	X		
Northern harrier		X							
Northern rough-winged swallow							X		
Orange-crowned warbler		X		X					
Osprey		X							
Pigeon		X							
Red-tailed hawk		X		X		X	X		
Red-shouldered hawk		X							
Ruby-crowned kinglet						X			X
Savannah sparrow				X		X			X
Say's phoebe		X				X			X
Scrub jay									
Song sparrow		X	X	X	X	X	X	X	X
Warbling vireo			X						
Western meadowlark		X				X			
White-crowned sparrow		X		X					
White-tailed kite		X							

Common Name	Pre-restoration (and during) *	Post-restoration *	Cooper (5/1/17) **	Cooper (12/1/17) **	Cooper (7/13/18) **	Cooper & Associates (2/12/19) **	Cooper & Associates (4/11/19) **	FBW – Cooper (07/30/19) **	FBW – Cooper (10/31/19) **
White-throated swift		X							
Wilson's warbler			X				X		
Yellow warbler			X	X			X		X
Yellow-rumped warbler		X							

Table 5. Wildlife species identified within the project footprint area. Note: the pre-restoration column also includes wildlife found during restoration events (see December 2016 report for more details).

Common Name	Pre-restoration (and during)	Post-restoration
Mammals		
Botta's pocket gopher		X
CA ground squirrel	X	X
Deer mouse		X
Desert cottontail rabbit		
South Coast marsh vole		
Western harvest mouse		X
Herpetofauna		
Alligator lizard	X	X
Gopher snake	X	X
Pacific tree frog	X	X
Side-blotched lizard		X
Southern California legless lizard		X
Western fence lizard	X	X
Invertebrates		
Batman lady beetle		X
Bristle fly		X
Bumble bee		X
Cabbage white butterfly	X	X
Cloudless sulphur butterfly		X
Common buckeye		X
Convergent lady beetle		X
Fiery skipper		X
Figeater beetle		X
Gray hairstreak		
Marine blue butterfly		X
Milk snail		X
Monarch butterfly		X
Orange sulphur butterfly		X
Salt marsh moth		X
Seven-spotted lady beetle		X
Short-horned grasshopper		X
Sonoran bumble bee		X

Square-headed wasps		X
Tiger moths		X
Wandering skipper	X	X
Western honey bee		X
Western pygmy blue		X
Western tiger swallowtail		X
Wolf spider		X
Wooly darkling beetle		X
Yellow-faced bumble bee		X
Unk. black moth		X
Unk. brown moth		X

Note: Coyotes were seen outside project boundary across Culver Blvd. Raccoon tracks were seen inside project boundary.

Figure 32. A common buckeye (top) and wandering skipper (bottom) in a restored area on 3 June 2022.

Photo-point

A series of geotagged photo-points were established to document change over time at the restoration site. The photos provide a series of "after restoration" visual representations of tarped and hand-pulled restoration areas over time. To date, five permanent, photo-monitoring locations (Figure 33 and Table 6) have been established to visually document the restoration site over time. Stations were located using GPS and baseline photographs. Photo point stations 1 through 3 were established in November 2016 with 15 total photos, station 4 was established during Year 3 (September 2018) with seven total photos, and stations 5a and 5b were added during this reporting year (Year 6, November 2021). Photo

point monitoring at each station is represented in Appendix A. Additional photos of restoration areas over time and before and after restoration events have been included throughout this report.

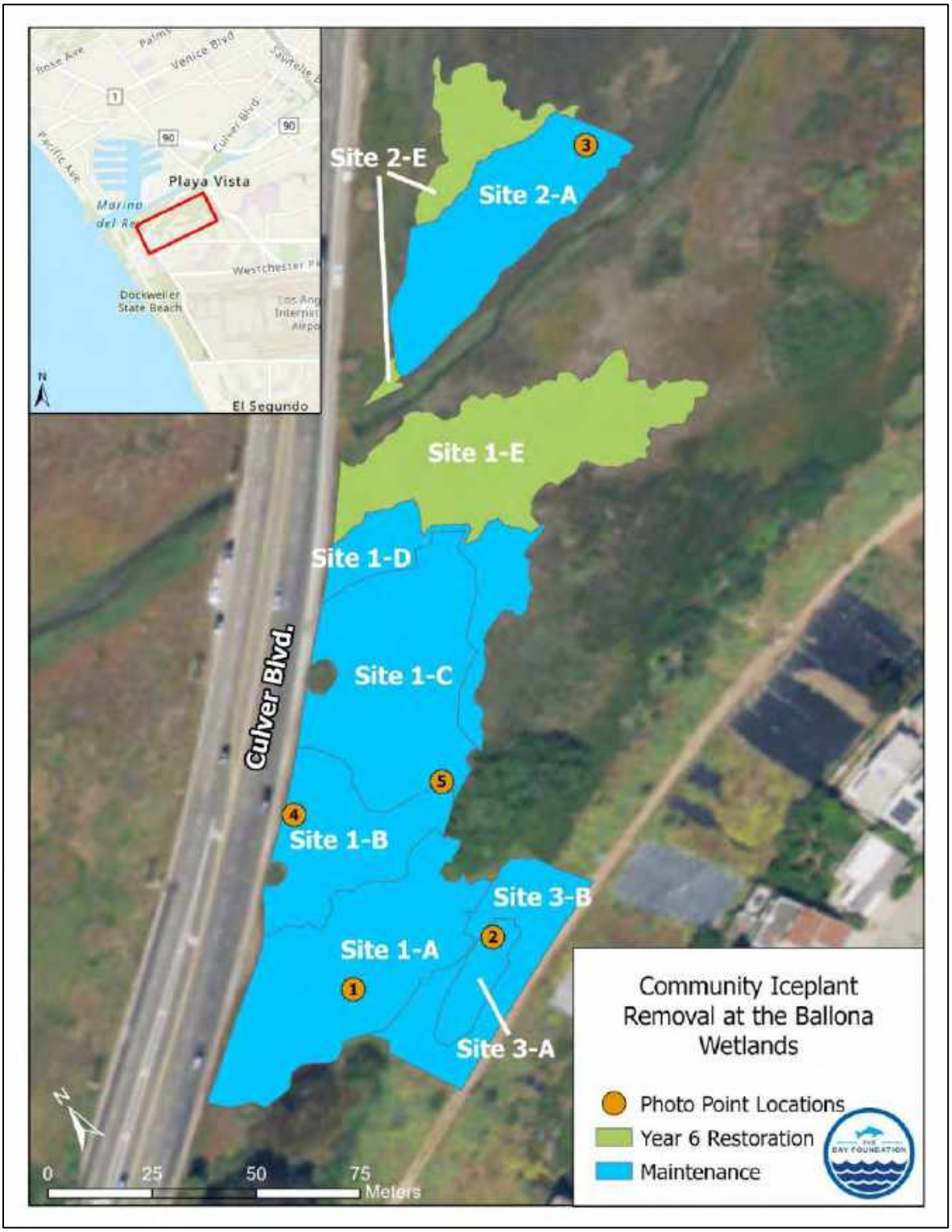


Figure 33. Location of photo point monitoring stations.

Table 6. Photo point stations, approximate bearing, and number of photos.

Station	Approximate Bearing	Total Number of Photos	Date Established
1	70°	21	29 November 2016
2	300°	23	29 November 2016
3	270°	23	29 November 2016
4 (a,b)	173°; 61°	15	20 September 2018
5(a,b)	273°; 13°	3	17 November 2021

Permitting

TBF, in coordination with the California Department of Fish Wildlife (CDFW), obtained permits to implement the Ballona Wetlands Community Iceplant Removal Project. On 10 March 2016, the California Coastal Commission (CCC) approved Coastal Development Permit (CDP) No. 5-15-1427 for the removal of non-native iceplant, from the targeted 3-acre area within the Ballona Wetlands Ecological Reserve, south of Culver Boulevard with several conditions. Only a portion of this iceplant removal has occurred as described in this report. Additionally, a CEQA exemption was filed and obtained by CDFW to implement this project.

Special conditions of CDP No. 5-15-1427 included:

1) Timing of operations prohibiting vegetation eradication and removal, hauling, annual maintenance and spot removal from 1 February through 30 August to avoid impact to avian species during breeding season;
2) Submittal of a plan to monitor and remove invasive non-native plants from the project area; and,
3) Disposal of materials outside the coastal zone.

On 14 July 2016, permit conditions were satisfied, and CDP No. 5-15-1427 was issued. Shortly after the first report was drafted in December 2016 (not a requirement of the permitting process, but an extra report prepared by TBF), TBF contacted Commission staff in January 2017 seeking a permit amendment to allow tarping and solarization for three months versus two months (to facilitate a higher percentage of iceplant desiccation), and the ability for TBF staff to conduct as-needed smaller spot removal events to pull weeds year-round. In April 2017, TBF (on behalf of CDFW) requested a permit amendment (CDP No. 5-15-1427-A1) to adjust the timing restriction condition of the underlying permit to allow year-round weed pulling to facilitate better management of invasive plant growth in the project area. Objections were made against the requested permit amendment which resulted in the amendment request becoming “material” and needing to go before a public Commission meeting for approval. Monitoring of the site continued; however, the “material” permit amendment process prevented TBF from being able to conduct spot-removal of weedy vegetation that came up following heavy winter rains in Year 1, thus negatively impacting the restoration process.

On 27 June 2017, a revocation request was submitted to the Commission by Ballona Wetlands Land Trust (BWLT). The revocation request (No. 5-15-1427-REV) resulted in an additional agenda item to be presented and reviewed during the 11 August 2017 Commission hearing. On 27 July 2017, TBF participated in a meeting organized by BWLT to discuss the project with a larger group of stakeholders to understand and address ongoing concerns with the project. At the CCC hearing on 11 August 2017, BWLT withdrew their revocation request No. 5-15-1427-REV, and CCC approved the amendment request by CDFW and TBF (No. 5-15-1427-A1), including an extension of project activities (spot removal by hand-pulling invasives) to be year-round for maintenance, and an extension of potential tarping deployment time, if needed. The permit amendment was issued on 12 September 2017.

On 22 May 2020, BWLT submitted a second request for permit revocation and enforcement to CCC regarding the project. TBF responded with a letter dated 2 June 2020 in an attempt to address BWLT

concerns. Subsequently, on 5 June 2020, BWLT submitted an amended request to require revocation proceedings for the project, with additional details, which included a request to revoke the permit and subsequently to "issue a new permit to allow the applicant to maintain the project areas" followed by an additional and presumably separate third permit to "expand the project area". TBF responded in a letter dated 24 June 2020. On 5 August 2020, CCC rejected the request to revoke the permit and further stated "… that the request is patently frivolous and without merit, and [CCC] will not initiate revocation proceedings."

TBF continues ongoing invasive vegetation management and scientific monitoring within the permitted project area in accordance with all permits and its associated documents. TBF recognizes that long-term dedication to improving the health of this project area in a degraded urban system is likely to require ongoing maintenance for a period of time. Activities such as weed removal or further seeding and planting of native plants will continue until the system is further stabilized with native cover. Ongoing adaptive management and scientific monitoring will continue to inform non-native vegetation removal in future years (see separate sections of this report for details).

All reports for this project are made publicly available on TBF's website: www.santamonicabay.org. The annual reporting time period is August through July of the following year. Coordination and communications are ongoing with CDFW and CCC staff.

Challenges

The importance of iceplant removal at a degraded urban site like the Reserve should not be understated. It is an invasive species that has increased in area on the Reserve by approximately 20% over the last several decades, covering approximately 30 acres of the Reserve prior to implementation of this project. While this project is focused on a relatively small area, it serves to inform future hand-restoration efforts both at the Reserve and throughout southern California. This project has been successful both at iceplant removal and at community engagement; however, ongoing maintenance of other invasive weedy vegetation remains a challenge in portions of the restoration area.

Restoration and enhancement activities in a heavily degraded urban environment continued to pose challenges in Year 6. Urban wetlands, like many other urban environments, experience significant impacts from non-native vegetation seed dispersal and growth, as well as encroachment from adjacent patches of non-native plants. The restoration site is immediately adjacent to a roadway, so it is possible that road transport and non-native seed dispersal via adjacent mechanisms may need to continue to be controlled through site maintenance. Additionally, natural native vegetation recruitment was strong in some areas of the site, especially where intermixed saltgrass was present in baseline conditions; however, some portions of the site continued to have low native plant recruitment, especially areas that were higher in elevation, that had several feet of dense iceplant monocultures in baseline conditions (pre-restoration), and those areas impacted by illegal activities (see subsection below). Plans for Year 7 include continued maintenance of non-native annual species to allow saltgrass and other native cover to continue to expand. Long-term restoration of the project site will likely require a period of ongoing effort to remove non-native, invasive vegetation (e.g., Table 7, and continued monitoring will inform necessary adaptive management decisions (see subsequent chapter).

Year 4, 5, and 6 Challenge – Illegal Vehicles and Sediment Dumping

Year 4 saw several substantial new challenges. One of the most significant was the series of illegal incursions on-site of vehicles which repeatedly impacted the restoration project area and progress, especially on project Sites 3-A, 3-B, 1-A, and 1-B (the hillside and below). Vehicles have ranged from personal cars, to tow trucks, to dump trucks. Beginning in July 2019, significant disturbance of the project site by trespassing vehicles from Cabora Road (above the project site) onto the Reserve caused recurring impacts to the hillside and additional areas of the project where the vehicles further drove across and through to reach Culver Boulevard. This was first publicly identified in the Year 3 Report (photographs from 31 July 2019). At least one additional illegal vehicle incursion occurred in summer 2019. Subsequently, on 14 November 2019, CCC informed a construction company that they were in violation of the Coastal Act (Violation #: V-5-19-0140) through unpermitted development including: (1) placement of fill in a wetland, (2) removal of major vegetation including native wetland vegetation as a result of driving through the wetlands and placing fill, and (3) change in the intensity of use of water resulting from altering the hydrology of wetlands through soil compaction, placement of fill and driving through the wetlands. Both the vehicles and the dumping of sediment on top of the restoration area caused impacts, especially to the seeded hillside, which was one of the focus areas of revegetation in Year 3. Erosion control mats were broken, new seedlings were trampled or uprooted, and soil was severely disturbed (Figures 34 and 35). Due to impacts from the driving (multiple incursions) and

placement of sediment, emergency erosion control actions were needed at the Reserve within the violation area. On 26 November 2019, TBF, with authorization from CDFW, applied for an Emergency Permit to address immediate potential impacts of the dumping within the restoration area through emergency erosion control measures. Photographs and additional details can be found in TBF's Emergency Permit application and in Figures 34 and 35, below.

While CCC continued enforcement conversations with the alleged violator, TBF was asked to temporarily refrain from project activities within the impacted area, which reduced weeding and revegetation efforts temporarily in those areas during a time when weedy annual vegetation was occurring. Conversations with CCC in June and July 2020 (Year 4) clarified the process for which the violator's impacts to the site would be resolved.

Year 5 saw the removal of illegally dumped sediment piles pursuant to California Coastal Commission Consent Executive Director Cease and Desist Order No. ED-20- CD-02. Removal of the trash and sediment piles occurred on 13 and 14 October 2020 (Figure 36). The removal was completed by HP Communication, Inc. construction crews and was conducted under the oversight of CDFW officials and TBF staff. Additionally, the construction work was monitored by a qualified biologist to ensure the protection of wildlife species and native soils, as well as spill prevention (MIG, 2020). Once the dumped sediment piles were removed, TBF implemented native container stock planting and seeding along the hillside and the rest of the impacted area of the restoration project site, in accordance with the Implementation and Monitoring Plan (see Revegetation section for details).

Year 6 showed positive development in the previously impacted area, as native species planted and seeded last reporting year (Year 5) continued to establish within the area. Weedy non-native annuals continued to be a challenge and were intermixed with native shrubs and herbs. Non-native annuals will require continued maintenance into Year 7.

Figure 34. Photographs taken of the impacted area of the hillside with disturbed soils and tracks before emergency measures were taken (top) and after erosion control mats were placed (bottom) (26 November 2019).

Figure 35. Photographs taken of one of the dumped sediment and trash piles in the restoration area before being covered (top) and after (bottom) (26 November 2019).

Figure 36. Photographs of the sediment and trash piles immediately before (top) and after (bottom) after removal from the restoration site (13 October 2020).

Year 4, 5, and 6 Challenge – COVID-19

Beginning in December 2019, a novel coronavirus outbreak began (SARS-CoV-2), which caused a disease known as COVID-19. Over the subsequent months, the virus and its associated disease spread globally and turned into a worldwide pandemic. As of end of July 2021, there have been over 195 million cases and over four million deaths worldwide, with close to four billion vaccines administered (Johns Hopkins University of Medicine, accessed 28 July 2021). Beginning in March 2020, the State of California and Los Angeles County Department of Public Health issued a "stay-at-home" order with specific restrictions on all activities.

These restrictions caused all on-site project activities from 20 March through 21 April 2020 to be cancelled or postponed in accordance with state and local guidance, including a restoration event on 10 March 2020. During this time, TBF and partners coordinated to adapt to these challenges by drafting safety guidelines and protocols to follow in the field, such as social distancing, face coverings, and limiting exchanges of any items. Once COVID-19 restrictions lessened slightly, TBF resumed non-public staff maintenance weeding activities in these areas (beginning end of April 2020), and weeding activities (e.g., hand removal, weed-whacking). Implementation of on-site project activities in response to COVID-19 requires extensive preparation, collaboration, and communication to prioritize human health, reduce safety risks, and follow local and State of California guidelines. When activities resumed, on 22 April 2020, they were limited to staff and some interns only. During Year 5, no public restoration events were allowed based on public health guidelines.

In August 2021 (Year 6), public restoration events resumed, in accordance with State and local COVID-19 guidelines for outdoor gatherings. Events continued through this reporting period, with COVID-19 safety measures, such as masks and caps on event participants, in place. Safety measures varied throughout Year 6 based on recommendations made by health officials, as well as TBF's internal polices related to COVID-19. Events are anticipated to continue into Year 7.

Adaptive Management Strategies

Monitoring combined with adaptive management actions can help address restoration challenges. Since the amendment was approved by the Coastal Commission, weed management within the restrictive permit conditions was subsequently expanded during Years 3 – 6. Weed succession refers to the growth of other weed species following the removal of one type of vegetation and is further discussed below after five years of data on plant regrowth. Unfortunately, many non-native species are highly adapted to respond quickly and grow much faster than their native competitors. While iceplant removal efforts were largely a success, with only scattered minimal re-growth present in a few areas, many other non-natives (including both perennials and annuals) continued to invade the site. However, the high level of invasion that was seen in Year 1 of a few key species shifted in Year 2 and was less present. Years 2 – 6 saw varied invasion based on project area and season, with some areas more resistant than others. A strong continued maintenance regime is recommended and will continue. At community restoration events, volunteer participants were given a thorough briefing on non-native plants being targeted during the event and were guided by TBF staff on removal techniques.

Table 7 provides a list of invasive species, with subsequent descriptions by species of the adaptive management efforts undertaken in Year 6, anecdotal results based on recurrence, and recommendations by species for Year 7. TBF will continue focus on removing the dominant invaders in Year 7 as part of ongoing long-term maintenance of the site and will also focus efforts on protecting the container stock native plants added in Year 5.

Ongoing Maintenance

Year 5 maintenance required less effort than the first implementation year, which allowed for a slight expansion of the project footprint, similarly to Year 4, but in a smaller expansion area. Lack of ability to host volunteers on site impacted maintenance efforts overall, though considerable staff and intern student time was dedicated to maintaining the site. Trends indicated fewer perennials including both iceplant and castor bean (only a few small sprouts of re-growth were identified within the previous project area and were removed). The primary target species for Year 5 included some small areas of perennial iceplant and castor bean, as well as a variety of annuals removed throughout the site including Geraldton carnation weed, wild radish, and brome grasses. For additional details by species, see subsections below and Table 7.

Year 5 restoration activities focused on strategically controlling non-native invasive vegetation within the previous restoration footprint (Years 1-4); additional native vegetation seeding and plantings; and continued hand restoration removal of iceplant and maintenance of weeds into the larger project area (still within the same permitted 3-acre area). Restoration included targeted areas supplemented with new native vegetation, allowing for establishment of seedlings and plantings. Primary species removed were annual wild radish and brome grasses, along with wild oat and sweet clover, and the perennial Geraldton carnation weed. Removal of non-natives continued to be targeted by flowering period for each individual species for maximum effectiveness (prior to seeding; Table 8). The following subsections provide details for the dominant vegetation invaders present within the restoration project area and suggested control methods. Tables 7 and 8 summarize maintenance information by species. All removed

non-native plant material will be disposed of offsite. One native species, Canadian horseweed, had small patch areas removed prior to planting and seeding events. This species, though native, can invade other native plant habitat areas to create dense monocultures, so it was controlled.

Table 7. Summary of weed maintenance adaptive management strategies by species (non-natives).

Scientific Name	Common Name	Growth Type	Year 6 Summary	Recommendations for Year 7
Atriplex semibaccata	Australian saltbush	Perennial	Present in low amounts in Site 2-A	Hand removal by roots
Atriplex prostrata	Fat-hen	Annual	Present in low amounts in Sites 1-B and 1-C; less than previous year	Hand removal by roots
Avena spp.	Wild oat	Annual	Present in moderate amounts along roadside; hand removed and weed whacked	Weed-whacker before seeding or hand removal by roots before seeding
Brassica spp.	Mustard	Annual	Present in low amounts in Year 6; primarily situated along the roadside; hand removed and weed whacked	Weed-whacker before seeding or hand removal by roots before seeding
Bromus spp.	Brome grasses	Annual	Present throughout; hand pulled in Sites 1-A, 3-A, and 3-B (hillside)	Weed-whacker before seeding or hand removal by roots before seeding
Carpobrotus spp.	Iceplant	Perennial	Almost no regrowth in Year 6; Opportunistically hand removed new sprouts	Hand removal by roots
Cortaderia selloana	Pampas grass	Perennial	Not targeted during Year 1 and Year 2; In Year 6, CDFW trimmed seedheads and applied herbicide to several plants along perimeter of site	Clipping and bagging of seed heads from plants within project area; manual removal of plants when feasible
Euphorbia terracina	Geraldton carnation weed	Perennial	Present throughout; hand pulled in Sites 1-A and 3-B	Hand removal by roots
Glebionis coronarium	Crown daisy	Annual	Present in low amounts in Sites 3-A and 3-B (hillside) and dense around periphery	Hand removal by roots or weed-wrench before seeding; expand perimeter maintenance
Lactuca serriola	Prickly lettuce	Annual	Present in Year 6, primarily along roadside; a couple large, concentrated patches along road in Sites 1-C and 1-D; hand removed; targeted for continued removal	Hand removal by roots or weed-whacked before seeding

Scientific Name	Common Name	Growth Type	Year 6 Summary	Recommendations for Year 7
Lysimachia arvensis	Scarlet pimpernel	Annual	Almost no presence in Year 6; no targeted removal	Hand removal by roots or weed-wrench before seeding
Melilotus indicus	Sweet-clover	Annual	Present in low amounts in Sites 1-A and 2-A; hand removed	Weed-whacker (or clipping) before seeding or hand removal by roots before seeding
Oxalis pes-caprae	Bermuda buttercup	Perennial	Low presence in Year 6 in Sites 3-B (hillside); hand removed	Hand removal by roots or weed-wrench before seeding; make sure to remove bulbs
Polypogon monspeliensis	Rabbitsfoot grass	Annual	Present in moderate amounts in Site 1-C and 1-D; hand pulled	Hand removal by roots
Raphanus sativus	Wild radish	Annual	Present in Year 6, especially around periphery and Sites 1-A, 3-A, and 3-B; hand removed throughout	Weed-whacker (or clipping) before seeding or hand removal by roots before seeding
Ricinus communis	Castor bean	Perennial	Very little regrowth after initial seed clipping and sprout pulling in fall 2017; almost no regrowth in Year 6, hand pulled when present; CDFW also removed some along peripheral of site	Bag seeds; hand removal by roots or weed-wrench before seeding; expand perimeter maintenance
Rumex crispus	Curly dock	Perennial	Present sporadically in Site 1-C and 1-D; hand removed	Hand removal by roots
Sonchus oleraceus	Common sowthistle	Annual	Present in Year 6 primarily along roadside, more than in previous years; hand removed	Hand removal by roots or weed-whacked before seeding

Table 8. Summary flowering period for invasive vegetation by month and species.

	Bloom Period											
Common Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Australian saltbush												
Fat-hen												
Wild oat												
Mustard												
Brome grasses												
Iceplant												
Pampas grass												
Geraldton carnation weed												
Crown daisy												
Prickly lettuce												
Scarlet pimpernel												
Sweetclover												
Bermuda buttercup												
Rabbitsfoot grass												
Wild radish												
Castor bean												
Curly dock												
Common sowthistle												

Perennial Non-native Species

Carpobrotus spp.

Iceplant re-growth was not present in significant amounts in Year 6, and the couple of individual plants that re-sprouted were easily removed. For future years, all iceplant sprouts present in the project area can be removed by hand and disposed of offsite. For additional details about iceplant, see the rest of this report and other information on the project webpage.

Euphorbia terracina

Geraldton carnation weed (*Euphorbia terracina*) was present in higher amounts during Year 2 than Year 1, and it continued to encroach from the perimeter, especially at Site 1-A and Site 3-B. During Year 3, the spread of Geraldton carnation weed seemed to be contained within Site 1-A and continued to be removed by hand during restoration events. During Year 4, a similar pattern was seen as Year 3. In Year 5, the Geraldton carnation weed was again present in Site 1-A, but also appeared in Site 1-C along the roadside and in small amounts in Site 3-B. During Year 6, Geraldton carnation weed was found in Site 1-A and 1-B, but in smaller amounts than previous years.

Geraldton carnation weed is a perennial (or biennial) herb that is not native to California and has the potential to spread rapidly (Cal-IPC). Like many other members of the spurge family, it produces toxic sap and has allelopathic properties that reduce germination of native plants (Cal-IPC). Although chemical

methods have shown success in controlling this plant, this project is limited to manual removal methods only; therefore, this invasive plant species will continue to be removed by hand, bagging plants which have gone to seed, and carefully minimizing soil disturbance around the area (Dorsey et al. 2010). Geraldton carnation weed seeds can exist in the seed bank for three to five years, so continued maintenance of removing this invasive before it goes to seed will be necessary to establish control (Randall and Brooks 2000). Year 7 recommendations include continued maintenance to deplete the seed bank.

Oxalis pes-caprae

During Years 3 and 4, there was minimal presence of Bermuda buttercup (*Oxalis pes-caprae*) compared to the higher densities in Year 2. Additionally, Bermuda buttercup grew earlier and was able to be targeted by ongoing community restoration events in the winter. Year 5 showed a similar pattern. In Year 6, there were low amounts of Bermuda buttercup in Site 3-B during the wetter months. The buttercup is a low-growing perennial herb (family Oxalidaceae) found along the coast of California (Cal-IPC). This buttercup does not produce seeds, but it has been shown to be difficult to control because of its ability to form many persistent bulbs and is often described as an "agricultural weed" (Cal-IPC). A loose basal rosette of leaves up to about 14 inches (35 cm) tall grows from the bulb and flowers bloom from November through April (UCIPM). While herbicides are commonly used to control this species (Stringer and Heath 2011), it can be removed by hand.

Cortaderia selloana

Pampas grass (*Cortaderia selloana*) is a large perennial grass found sporadically around the periphery of the project site. A few large stands exist within the permitted project site (not within the Year 1 footprint), and while Year 1 and Year 2 restoration activities targeted primarily iceplant followed by non-native annuals, Year 3 and 4 activities included clipping the seed heads from targeted pampas grass plants located in the extended project footprint and removing several juvenile plants completely. In Year 5, small individuals were bagged and removed from Site 1-D. During Year 6, CDFW staff worked on trimming seed heads and applying herbicide to pampas grass that exists around the restoration site perimeter. Year 7 recommendations include removal of pampas grass seedlings within the restoration area. Each flower (plume) from the pampas grass plant can produce up to 100,000 seeds that are widely dispersed by wind; thus, management of the spread of seeds within the project footprint will benefit not only the site but other portions of the Reserve.

Ricinus communis

Castor bean (*Ricinus communis*) did not appear to have large amounts of re-growth after efforts were made in fall 2017 to bag and remove all seed heads and to pull sprouts (approximately 400). Only a couple of individual sprouts were seen in spring 2018. During Years 3 and 4, small numbers of sprouts were pulled in Sites 3-A, 3-B, and 1-A. During Year 5, only a few sprouts of castor bean were observed and removed. The sprouts likely originated from large individuals bordering the project site. In Year 6, CDFW staff worked to cut down and remove some castor bean individuals along the restoration boundary. Castor bean is a perennial shrub, sometimes tree-like, that can grow three to 15 feet tall. Castor bean grows quickly in mild climates and has escaped cultivation to become a noxious weed in southern and central California (Bossard et al. 2000). Castor bean displaces native plant species by growing rapidly and shading out native seeds and seedlings. Additionally, the seeds of castor bean are

highly toxic to humans and wildlife such as rabbits, cats, dogs, and gophers (Robbins et al. 1941). As this plant spreads via seeds, seed heads from individual plants should be bagged prior to pulling plants by hand and removing the bulk of the root system. A weed wrench can be used to remove larger castor bean plants. Additional recommendations include expanding maintenance activities along the perimeter.

Atriplex semibaccata

Australian saltbush (*Atriplex semibaccata*) is a spreading, shrubby perennial and is invasive in coastal grasslands and scrub, and the higher ground of salt marshes. It is a prostrate ground cover plant that has an extensive flowering period. A small area of Australian saltbush was tarped in Year 1, and subsequently manually removed during community restoration events during Year 1 and Year 2 from within the project footprint at Site 2-A. During Year 3, Australian saltbush continued to be pulled from Site 2-A, and during Year 4, regrowth was limited to a patch within the same area; additionally, small sprouts and a handful of individuals were found and pulled on the base of the hillside at Site 3-B. During Year 5, sprouts and several dense patches were removed in Site 2-A. Smaller patches were observed in Year 6 in Site 2-A and will be targeted for future removal.

Rumex crispus

Curly dock (*Rumex crispus*) is a perennial non-native herb characteristic of disturbed areas and can be found in wetlands or non-wetlands. It produces a flower stalk that can grow up to over a meter in height. It was not present in the footprints of Years 1-3 and was only sporadically present in small amounts in a couple restoration areas (e.g., Sites 1-C and 1-D) in Years 4, 5, and 6.

Annual Non-native Species

Bromus spp.

Bromus spp. includes a variety of non-native annual brome grasses such as ripgut brome (*Bromus diandrus*), soft brome (*Bromus hordeaceus*), and foxtail brome (*Bromus madritensis*), exhibiting similar graminoid growth patterns and reproducing by seed (Cal-IPC). These species had patchy presence throughout the restoration areas and should continue to be cut or pulled before seeds form. These species are characteristic of disturbed habitats and are common “weedy” grasses. In California, they contribute to altered patterns of wildfire, altered microhabitat characteristics, and altered nutrient cycling and competition for soil nutrients and light (Cal-IPC). Seeds of brome grasses can cling to people and are easily spread. Care should be taken not to transport the seeds from other areas onto the project area. During Year 4, brome grasses continued to be problematic, especially closer to Culver Boulevard. During Year 5, these non-natives were reduced using a weed whacker prior to seeding in Site 1-A and 3-B, and removal was focused on individuals crowded around newly planted container stock. In Year 6, brome grasses continued to be observed in Sites 1-A and 3-B, and removal was focused around recently planted shrubs. Year 7 recommendations include the use of a weed whacker in Site 1-A, where ripgut brome is intermixed with native saltgrass.

Glebionis coronaria

Crown daisy (*Glebionis coronaria*) was not identified in the restoration areas during Year 2 but has been identified on the periphery adjacent to the Year 1 restoration sites, especially along the base of the

bluff. During Year 4, crown daisy was observed and pulled on the hillside of Sites 3-A and 3-B, though in much lower densities than Year 3. Year 5 showed a similar distribution. In Year 6, very little crown daisy was observed in Site 3-B. Crown daisy is a flowering annual, commonly found in coastal California, and can invade a variety of habitats. This common ornamental plant escapes gardens settings and easily invades disturbed areas (Cal-IPC). The seeds of this species sprout quickly after rain and can grow up to five feet tall. Dense stands can crowd out native vegetation and dead plant mass can also prevent native plants from recolonizing if not removed (Tuttle et al. 2011). Crown daisy can be removed by hand or weed wrench. For Year 7, the adjacent crown daisy should continue to be assessed, and additional recommendations for this species include expanding maintenance activities along the perimeter.

Lactuca serriola

Prickly lettuce (*Lactuca serriola*) is a common winter annual or biennial broadleaf plant that was not identified in the restoration areas prior to Year 6. It was present in Sites 1-C and 1-D in large patches along the roadside, intermixed with common sowthistle. This species inhabits agricultural land, annual grasslands, seasonal wetlands, and roadsides, occurring in mostly disturbed habitats. Mature plants can grow up to 6.5 feet tall and produce flowers from mid to late summer. Small infestations should be removed before the plant produces seed, by removing the entire plant. Year 7 recommendations include continued hand removal and maintenance.

Lysimachia arvensis

Scarlet pimpernel (*Lysimachia arvensis*) is a small annual (can be biennial) non-native broadleaf herb that was present in Site 1-A and 3-B as small scattered individual plants in Year 2. During Years 3 and 4, only a couple of sprouts of scarlet pimpernel were observed and removed in portions of Sites 3-A and 3-B. In Year 5, very few individuals were observed and removed. During Year 6, little to no scarlet pimpernel were observed in the restoration area. The species is commonly found in man-made and disturbed habitats and is tolerant of wetland habitats. If consumed, it can be toxic to livestock and humans (UCIPM). Mature plants can grow up to approximately 1.3 feet with upright or prostrate stems. Small salmon-orange colored flowers are produced from March through July (UCIPM), and it reproduces by seed. This species can be removed by hand or weed wrench. Year 7 recommendations include removing reoccurring individual sprouts.

Melilotus indicus

Sweetclover (*Melilotus indicus*) was present in much smaller amounts during Year 2, when compared to the maintenance efforts of Year 1. Sweetclover was somewhat problematic in Site 2-A during Years 3 and 4, with little invasion in other restoration sites, but overall the species was found in much lower densities than Year 1. In Year 5, it continued to be found in small amounts in Site 3-B, and in denser patches by the road in Site 1-D. In Year 6, sweetclover was present in low amounts in Site 1-A and 2-A. This non-native annual (can be biennial) herb that blooms from April through October, can grow up to approximately two feet in height, and is fairly tolerant of saline soils (Calflora). This plant is often poisonous to mammals and can have a persistent seed bank of up to 20 years (Florabase). Plants should be hand removed before seeds are formed. If using a weed-whacker, the plant needs to be cut below the lowest branch axil to prevent resprouting. For Year 7, continued maintenance of any regrowth should occur, and additional recommendations for this species include expanding maintenance activities along the perimeter.

Raphanus sativus

Wild radish (*Raphanus sativus*) was present in Year 2 in smaller amounts than Year 1 but was a significant presence around the periphery of the restoration area. During Years 3 and 4, wild radish continued to be a common invader in the restoration site, especially in the hillside area (Sites 3-A and 3-B). Radish was less dense in areas with established native cover (e.g., saltgrass and Canadian horseweed) and denser in areas with little to no native cover. Prior to restoration activities occurring in November 2020, radish was removed from the site. After planting and seeding in Sites 3-A and 3-B, moderate amounts of wild radish occurred along the hillside and were hand removed. In Year 6, wild radish continued to sprout up in Sites 1-A, 3-A, and 3-B intermixed with native vegetation but most was removed before seed became viable. Radish is an herbaceous annual that frequently invades disturbed areas, including roadsides, and can also be found in wetland areas (Holloran et al. 2004). Wild radish can grow up to three feet or taller and reproduces only by seed. Seeds can remain viable for long periods of time and can germinate in spring or fall depending on weather. Wild radish plants with seeds present will be bagged and removed from the site. Removal can occur manually by hand or weed wrench. Plants should be hand removed before seeds are formed. Additional recommendations for this species during Year 7 include controlling wild radish within the restoration site and expanding maintenance activities along the perimeter.

Sonchus oleraceus

Common sowthistle (*Sonchus oleraceus*) was present in small amounts in various places throughout the restoration area in Year 4. A similar distribution was seen in Year 5, with small patches of the non-native found along the roadside in Site 1-B. During Year 6, sowthistle was observed in denser patches by the roadside in Site 1-D, along with prickly lettuce. Sowthistle is a common annual (can be biennial) broadleaf plant that is frequently found in disturbed soils. It has hollow stems, releases a milky sap when cut open, and can reach over four feet in height. The yellow flowers mature into fluffy white seed heads, and this species reproduces by wind-dispersed seed. A single plant can produce up to 8,000 seeds (Florabase). Seed is able to germinate all year round over a broad range of temperatures and light availability (Cal-IPC). This species has been known to be resistant to herbicides and manual removal techniques are recommended. Populations can be removed by hand or by weed wrench. Cutting is often ineffective, as flowers can continue to be produced from cut stems. Recommendations for Year 7 include continued hand removal and maintenance.

Polypogon monspeliensis

Rabbitsfoot grass (*Polypogon monspeliensis*) is an annual non-native grass. Native to southern Europe, this grass has large fluffy inflorescence and can grow in height to over three feet (including seed stalks). During Years 4 and 5, several small patches were present in Site 1-C and subsequently removed. During Year 6, patches of grass continued to sprout within Site 1-C and 1-D. Patches of grass were partially removed and will be targeted for future events.

Atriplex prostrata

Fat-hen (*Atriplex prostrata*) an annual non-native herb that can be found in wetland habitats. During Year 4, individuals were present scattered throughout Sites 1-B and 1-C, though they were not targeted as a high priority invasive species. In Year 5, the presence of the non-native increased in Sites 1-B and 1-

C and some individuals were removed. During Year 6, fat-hen was observed in lower amounts throughout Sites 1-B and 1-C. Recommendations for Year 7 are continued hand removal and maintenance.

Conclusions

Iceplant is a ground-hugging succulent that can grow deep, nearly impenetrable mats several feet thick, which dominate resources along a range of soil moisture and nutrient conditions. Iceplant provides little protection or useable habitat for native birds and wildlife. Additionally, its shallow, fibrous root network consumes large quantities of available water year-round and alters soil chemistry, further impeding the growth of native species, with the largest impact occurring during times of drought. Most significantly, the highly competitive characteristics of iceplant for available nutrients, water, light, and space allows it to suppress the growth of native seedlings and often results in the growth of large, monospecific stands providing minimal habitat value. Iceplant also alters soil conditions, making the influx of native vegetation species difficult.

The importance of iceplant removal at a site like the Ballona Reserve should not be understated. It is an invasive species that has increased in area on the Reserve by approximately 20% over the last several decades, covering approximately 30 acres of the Reserve (prior to implementation of this project). While this project was focused on a relatively small area, it serves to inform future hand-restoration efforts both at the Reserve and throughout southern California. Both restoration methods (i.e., tarping and hand-pulling iceplant) were successful at removing iceplant and engaging the local community and school groups to varying degrees. Over the course of six implementation years, an estimated total of over 51.66 tons of iceplant were removed from the site, with removal of hundreds of bags of other non-native invasive plants species. Additional efforts to continue to engage the public are made available through these reports, the project webpage, periodic newsletters, project partners, and engagement through social media. Allowing students and the community to actively participate in improving the health of the Reserve will encourage stakeholder involvement in the larger restoration process for the whole Reserve and broaden the hands-on educational opportunities for Los Angeles. For all years combined, 606 volunteers contributed 1,516 hours across 53 community restoration events.

While the initial results of the tarping and hand-pull restoration efforts successfully removed iceplant with very little regrowth exhibited, Year 6 saw the continued need for maintenance of non-native vegetation. In particular, areas lacking some mixed native cover in the baseline conditions and along the roadside required attention for removal of non-native annual species. However, many of the annual non-native species died out in the late spring / early summer months. In addition, some areas of the project demonstrated high native plant cover expansion (e.g., Sites 1-B, 1-C, and 1-E). The substantial effort to reseed and plant native container stock vegetation last reporting year (Year 5) increased the native species richness and cover in many areas, with noticeable differences prominent in the hillside areas (e.g., Sites 3-A, 1-A). New native species, such as branching phacelia (*Phacelia ramosissima*), seacliff buckwheat (*Eriogonum parvifolium*), California sagebrush, beach evening-primrose, white sage, and many more, successfully established with many increasing substantially in size from their original 4-inch pots or one-gallon pot sizes (Figure 37). Seacliff buckwheat may one day support the endangered El Segundo blue butterfly once the plants mature. Existing native plants such as alkali weed, saltgrass, and alkali heath continued to increase in cover. Results suggest that the container stock was more effective than seeding, though increasing the native seed bank will only have beneficial long-term effects.

Ongoing and long-term monitoring and maintenance will be needed due to the high level of degradation of the Reserve and the lack of tidal influence to the salt marsh. Tidal influence would encourage more native vegetation growth of native plants tolerant to saline conditions. Continued adaptive management such as targeted non-native and invasive weed removal will allow for enhancement in future years, as restoration efforts continue. In addition, continued restoration and monitoring will improve the understanding of invasive plant succession within the restoration area over the long-term and may provide potential habitat to wildlife species. Saltgrass continues to expand within the restoration area, especially in areas that had some pre-restoration baseline cover prior to iceplant removal. As saltgrass is the preferred habitat for rare species such as the wandering skipper, the iceplant removal efforts are likely to help support this species and others in future years.

While the initial efforts specifically targeted at iceplant removal were successful, with minimal re-growth of iceplant, additional restoration events are needed to continue to remove other non-native invaders in the future. Additional recommendations include further expanding the perimeter to restrict encroachment of non-natives into the project area. Lastly, additional efforts to monitor and implement adaptive management strategies as necessary will be utilized in Year 7.

In Year 6, there was significant restoration progress despite the challenges faced in Years 4 and 5. During Years 4 and 5, challenges included a series of illegal incursions on-site of vehicles which repeatedly impacted the restoration project area and progress, and the dumping of sediment and construction debris on the hillside area of the restoration. Additionally, the restrictions and challenges associated with SARS-CoV-2 and COVID-19 required extensive preparation to prioritize human health, reduce safety risks, and follow regulatory restrictions. Not being allowed to have public restoration events hindered site progress during Year 5. During Year 6, the area previously impacted by illegal vehicle incursions and sediment dumping displayed establishment of native species that were planted and seeded the previous reporting year. In addition, community events resumed with COVID safety measures in place, such as face coverings, social distancing, and participant caps on events. The resumption of community restoration events amplified the impact of restoration efforts.

TBF recognizes that long-term dedication to improving the health of this project area in a degraded urban system is likely to require ongoing maintenance for a period of time. Activities such as weed removal or potential further seeding and planting of native plants will continue until the system is further stabilized with native cover. Ongoing adaptive management and scientific monitoring will continue to inform non-native vegetation removal in future years.

Figure 37. Native container stock plants established on site including an assemblage of branching phacelia, California sagebrush, and white sage (top left), white sage (top right), beach evening primrose (bottom).

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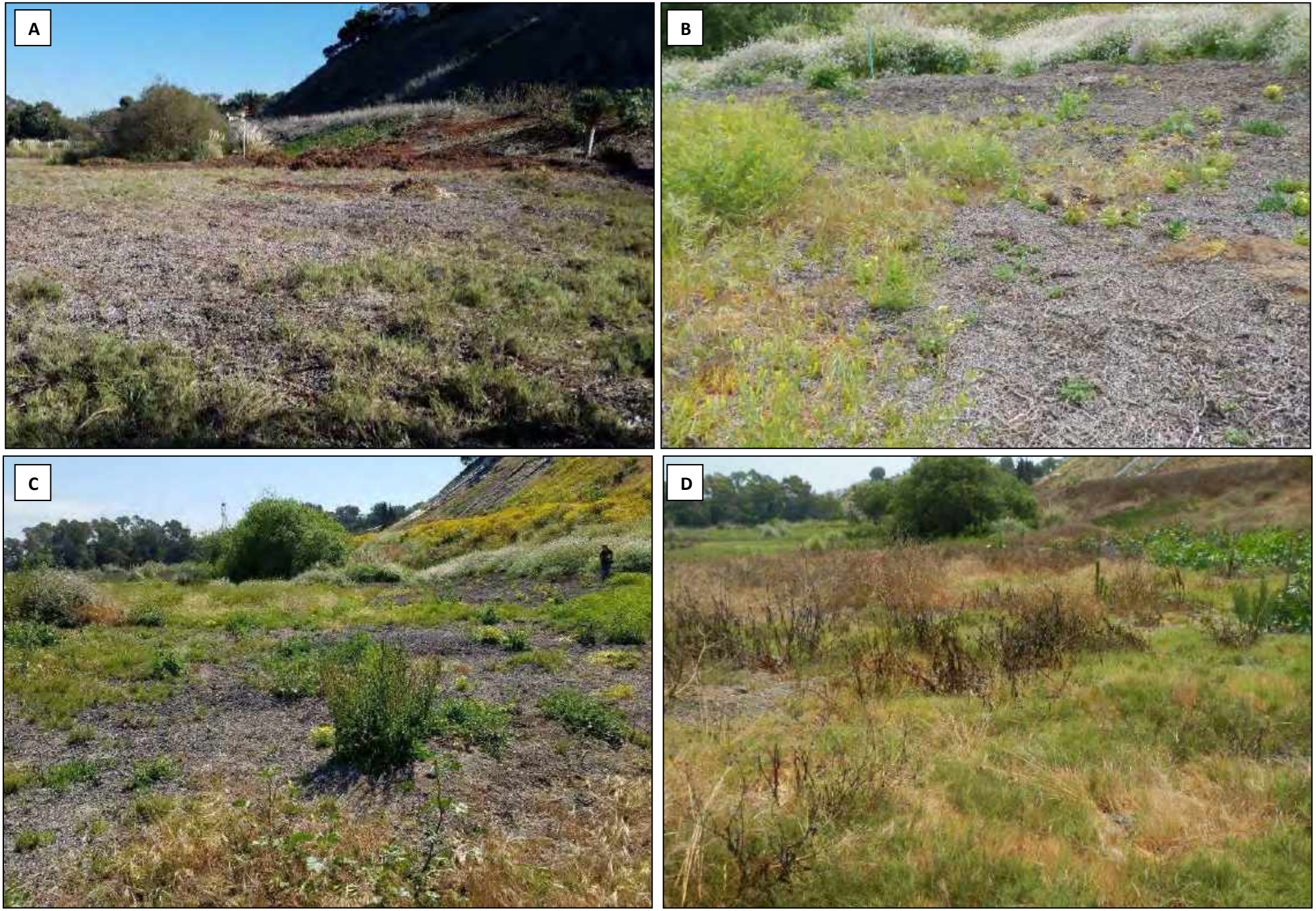

Figure A-1. Photo Point 1 at bearing 70° on (A) 29 November 2016; (B) 25 April 2016; (C) 2 May 2017; (D) 12 July 2017.

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Figure A-2. Photo Point 1 at bearing 70° on (E) 12 August 2017; (F) 6 March 2018; (G) 18 May 2018; (H) 31 July 2018.

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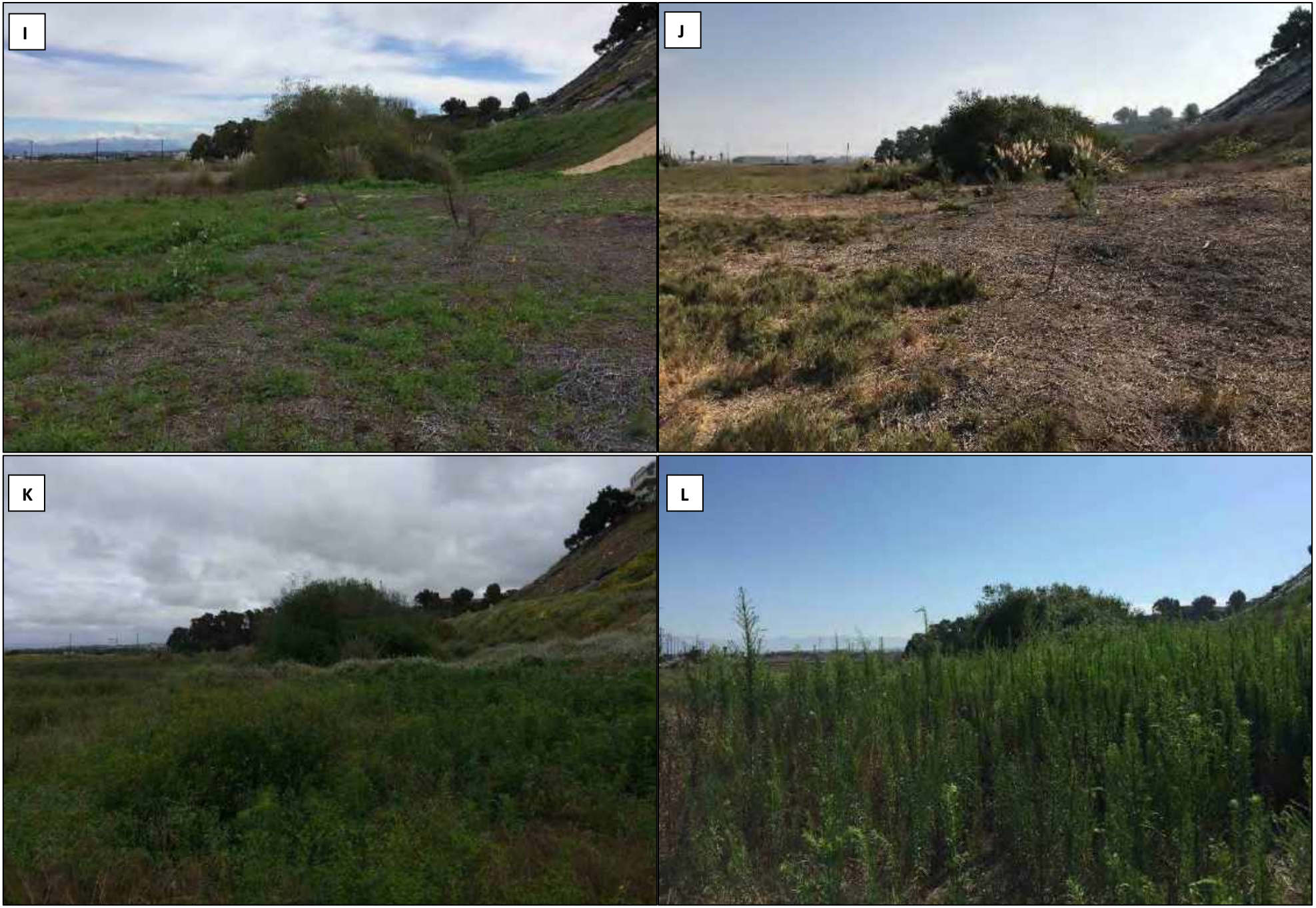

Figure A-3. Photo Point 1 at bearing 70° on (I) 20 September 2018; (J) 21 February 2018; (K) 30 April 2019; (L) 24 July 2019.

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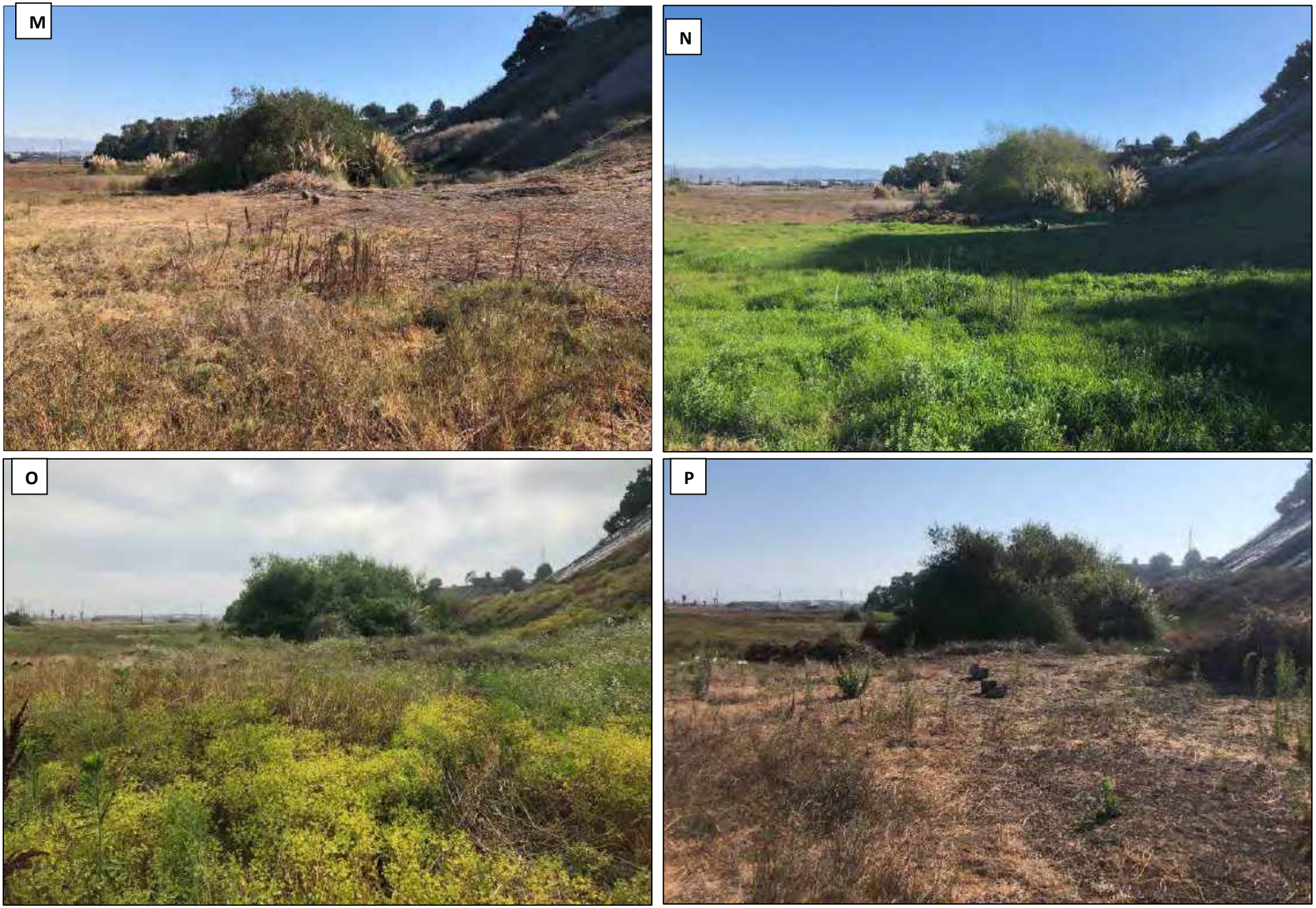

Figure A-4. Photo Point 1 at bearing 70° on (M) 31 October 2019; (N) 11 February 2020; (O) 2 June 2020; (P) 28 August 2020.

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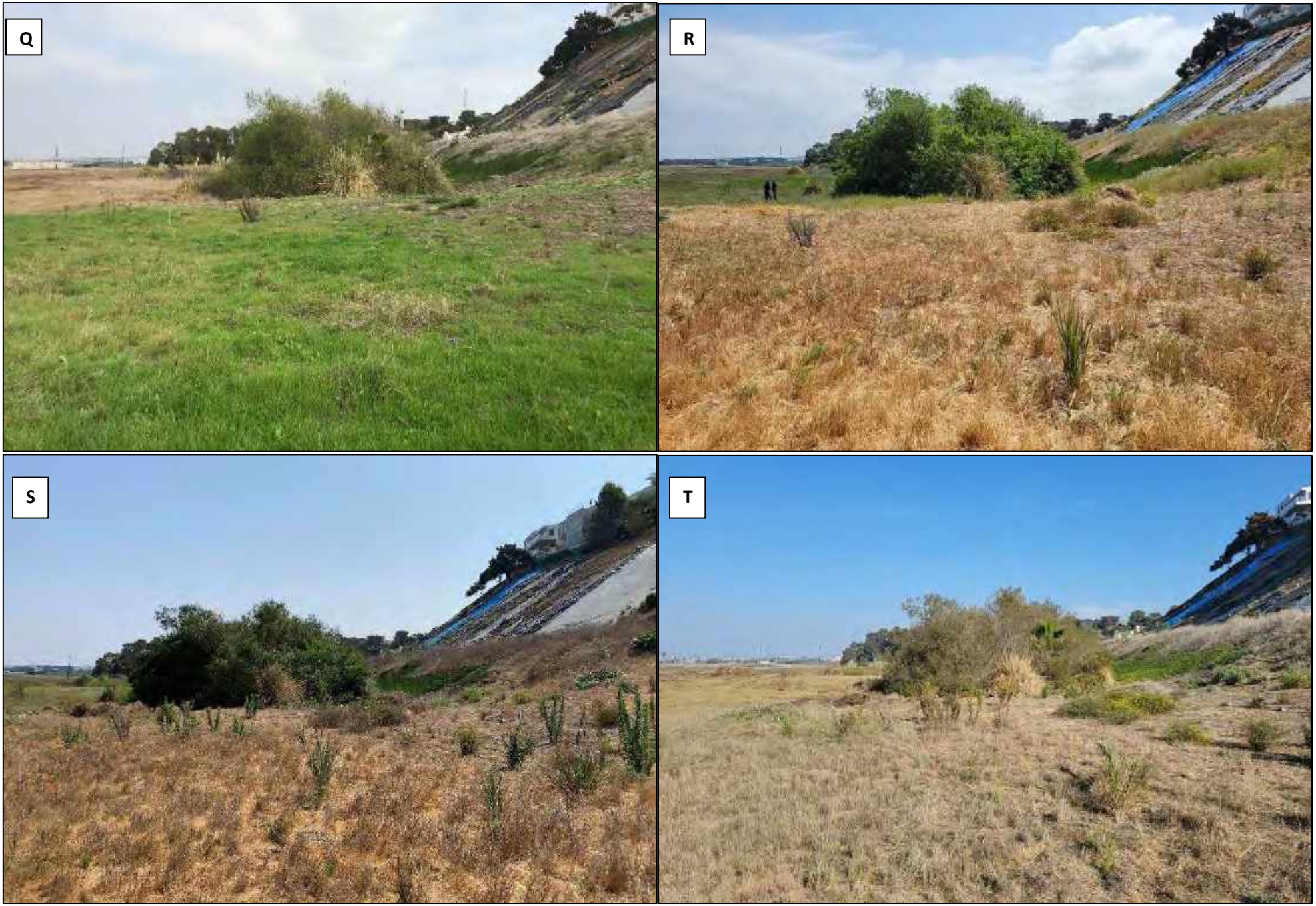

Figure A-5. Photo Point 1 at bearing 70° on (Q) 9 February 2021; (R) 18 May 2021; (S) 24 August 2021; (T) 17 November 2021.

Figure A-6. Photo Point 1 at bearing 70° on (U) 28 February 2022.

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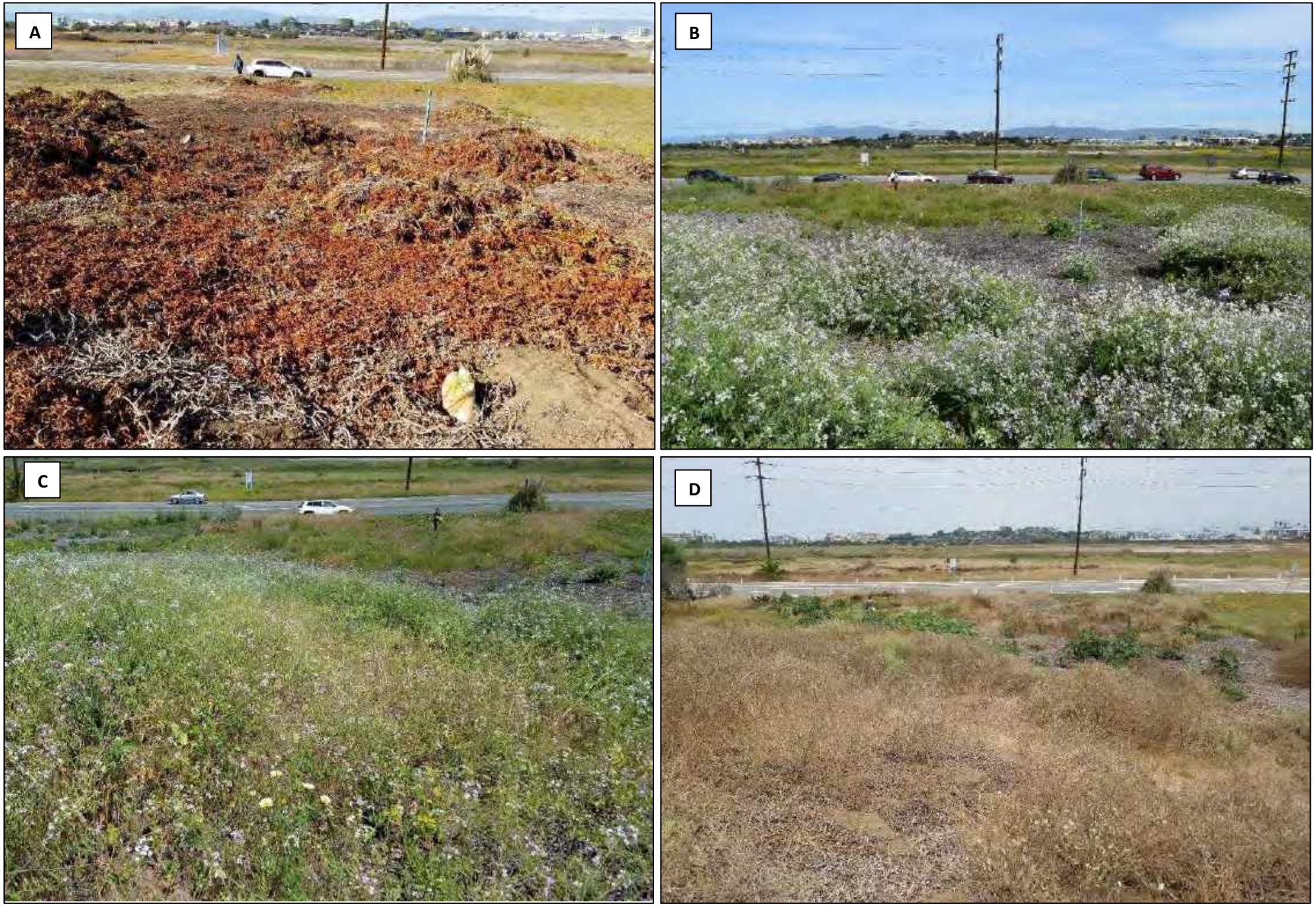

Figure A-7. Photo Point 2 at bearing 300° on (A) 29 November 2016; (B) 25 April 2017; (C) 2 May 2017; (D) 12 July 2017- different than Year 2 report, bearing accurate.

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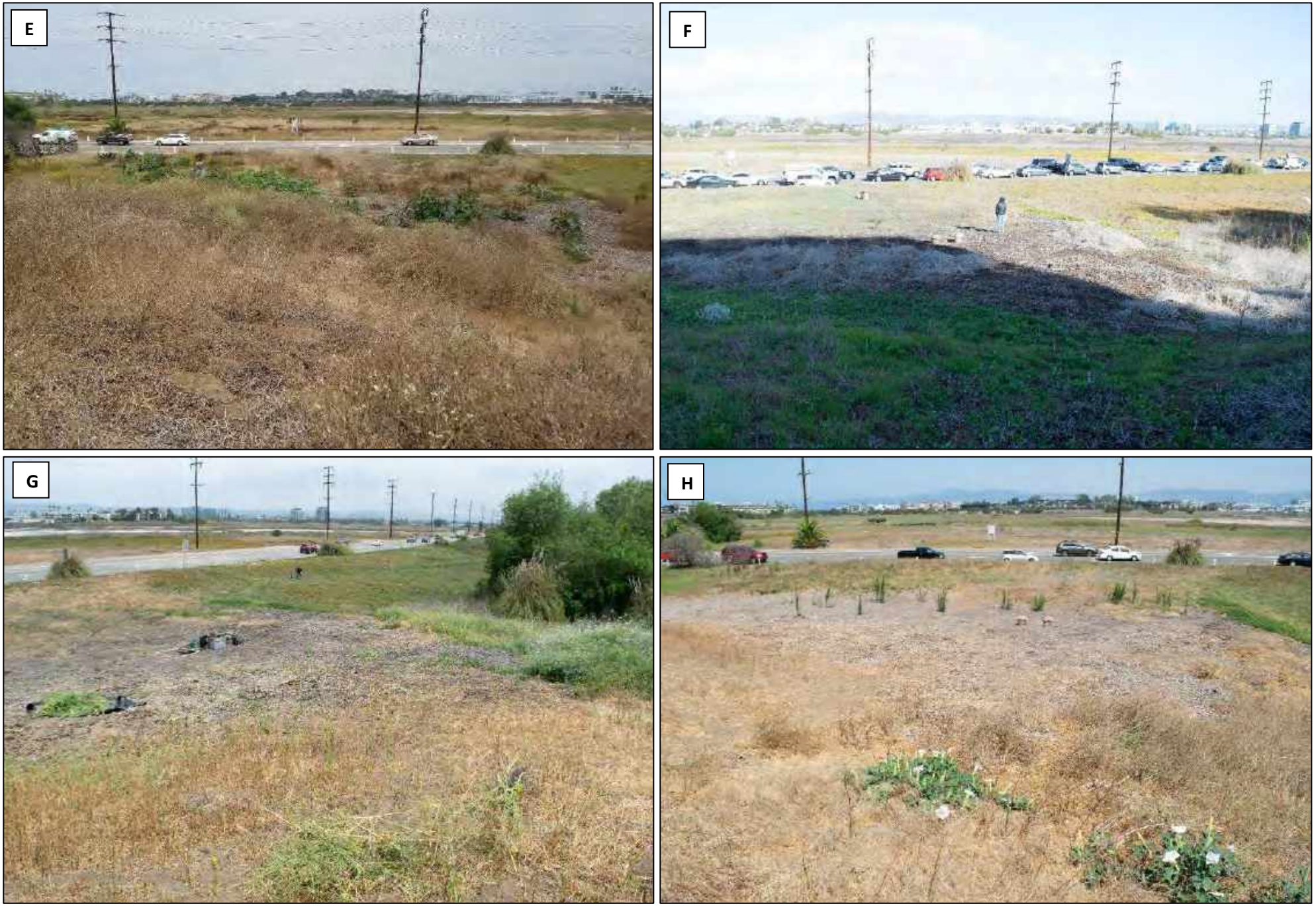

Figure A-8. Photo Point 2 at bearing 300° on (E) 12 August 2017; (F) 27 February 2018; (G) 18 May 2018; (H) 31 July 2018.

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Figure A-9. Photo Point 2 at bearing 300° on (I) 20 September 2018; (J) 21 February 2018; (K) 30 April 2019; (L) 24 July 2019.

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Figure A-10. Photo Point 2 at bearing 300° on (M) 31 October 2019; (N) 11 February 2020; (O) 2 June 2020; (P) 28 August 2020.

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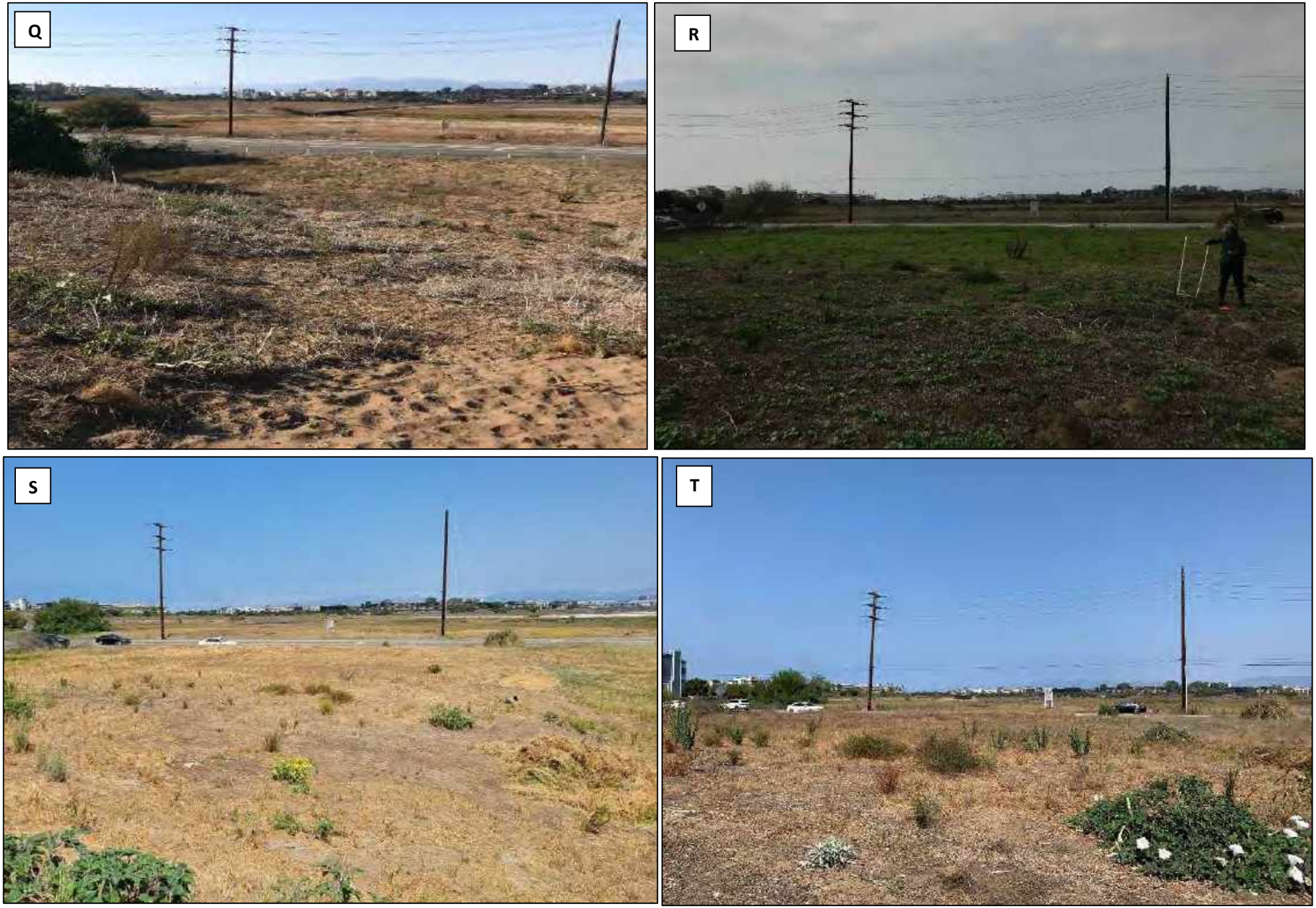

Figure A-11. Photo Point 2 at bearing 300° on (Q) 12 November 2020; (R) 9 February 2021; (S) 18 May 2021; (T) 24 August 2021.

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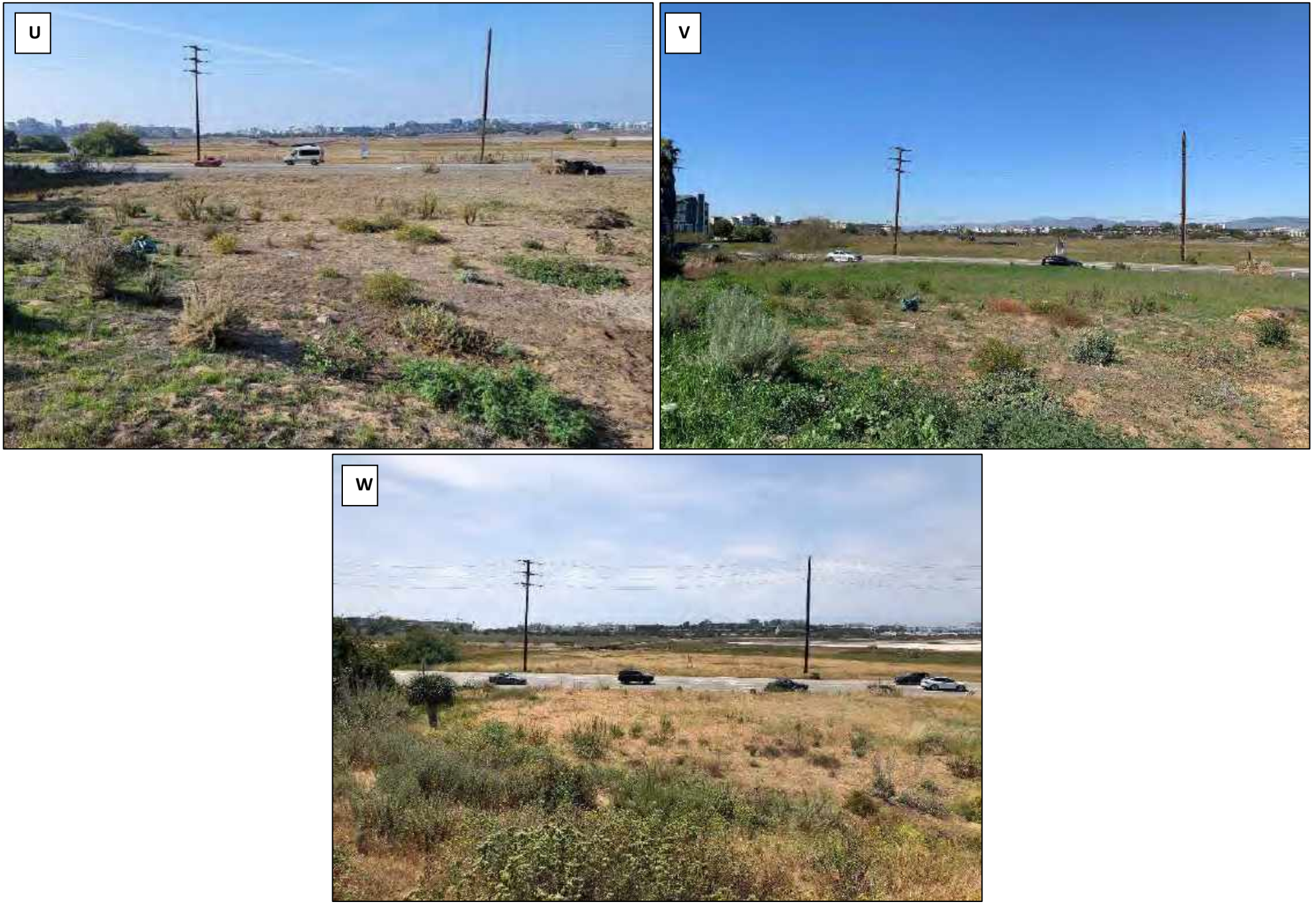

Figure A-12. Photo Point 2 at bearing 300° on (U) 17 November 2021; (V) 28 February 2022; (W) 03 June 2022.

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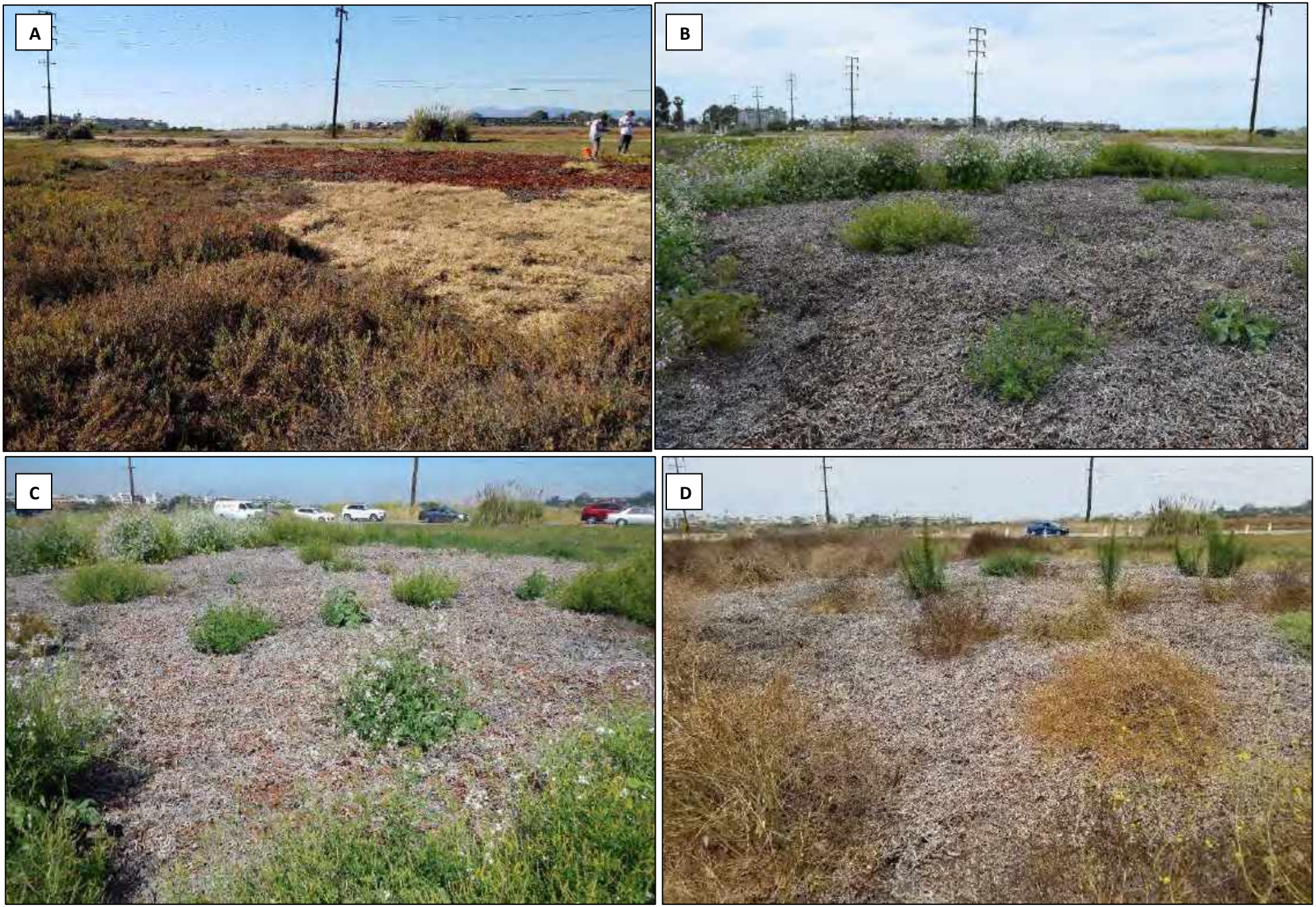

Figure A-13. Photo Point 3 at bearing 270° on (A) 29 November 2016; (B) 25 April 2017; (C) 2 May 2017; (D) 12 July 2017.

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Figure A-14. Photo Point 3 at bearing 270° on (E) 12 August 2017; (F) 16 November 2017; (G) 18 April 2018; (H) 31 July 2018.

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Figure A-15. Photo Point 3 at bearing 270° on (I) 20 September 2018; (J) 21 February 2018; (K) 30 April 2019; (L) 24 July 2019.

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Figure A-16. Photo Point 3 at bearing 270° on (M) 31 October 2019; (N) 11 February 2020; (O) 2 June 2020; (P) 28 August 2020.

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Figure A-17. Photo Point 3 at bearing 270° on (Q) 12 November 2020; (R) 9 February 2021; (S) 20 May 2021; (T) 24 August 2021.

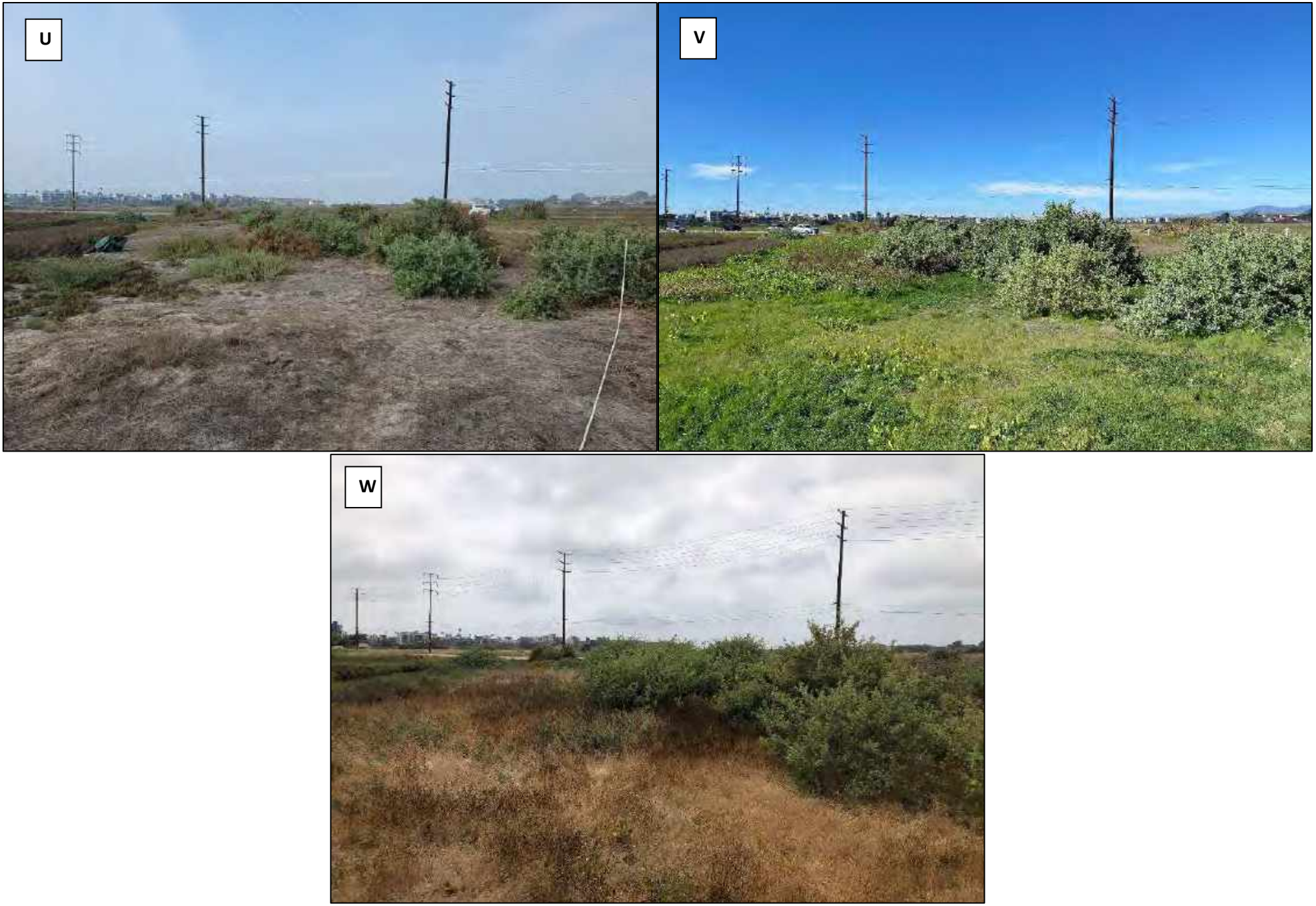

Figure A-18. Photo Point 3 at bearing 270° on (U) 17 November 2021; (V) 28 February 2022; (W) 03 June 2022.

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Figure A-20. Photo Point 4a at bearing 173° on (A) 20 September 2018; (B) 21 February 2019; (C) 30 April 2019; (D) 24 July 2019.

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Figure A-21. Photo Point 4a at bearing 173° on (E) 31 October 2019; (F) 11 February 2020; (G) 2 June 2020; (H) 28 August 2020.

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Figure A-22. Photo Point 4a at bearing 173° on (I) 12 November 2020; (J) 9 February 2021; (K) 18 May 2021; (L) 24 August 2021.

Figure A-23. Photo Point 4a at bearing 173° on (M) 17 November 2021; (N) 28 February 2022; (O) 03 June 2022.

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Figure A-24. Photo Point 4b at bearing 61° on (A) 20 September 2018; (B) 21 February 2019; (C) 30 April 2019; (D) 24 July 2019.

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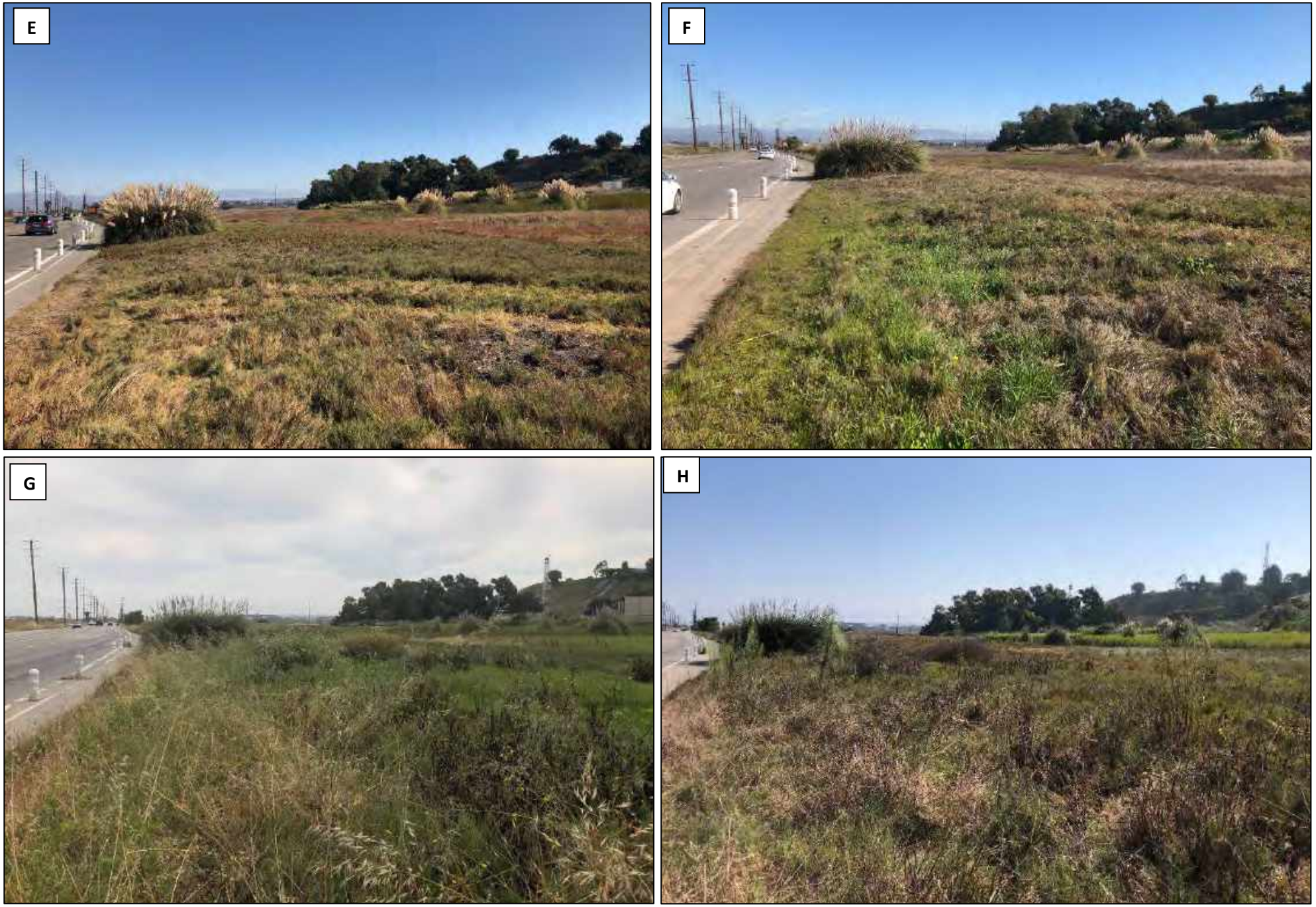

Figure A-25. Photo Point 4b at bearing 61° on (E) 31 October 2019; (F) 11 February 2020; (G) 2 June 2020; (H) 28 August 2020.

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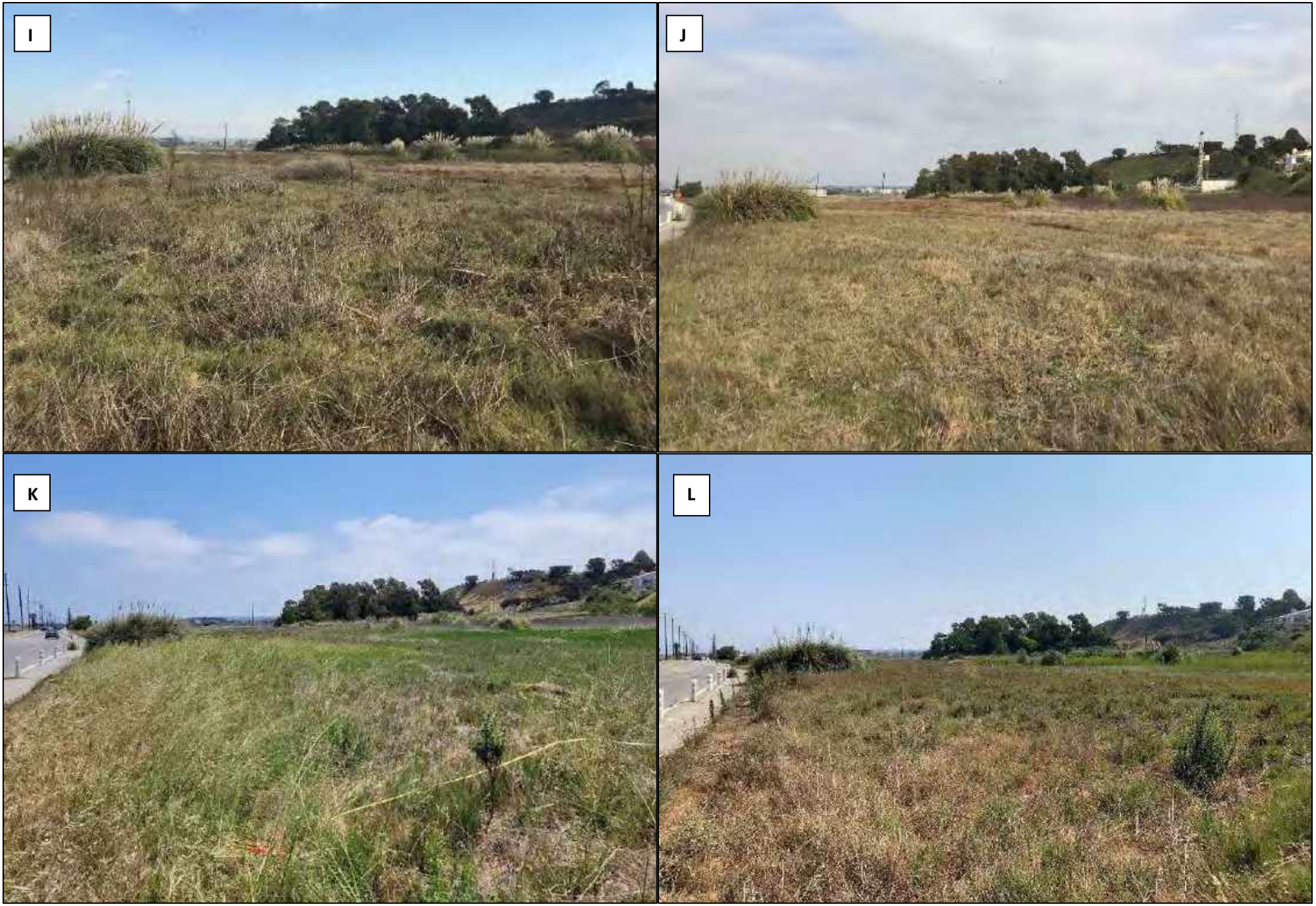

Figure A-26. Photo Point 4b at bearing 61° on (I) 12 November 2020; (J) 9 February 2021; (K) 18 May 2021; (L) 24 August 2021.

Figure A-27. Photo Point 4b at bearing 61° on (M) 17 November 2021; (N) 28 February 2022; (O) 03 June 2022.

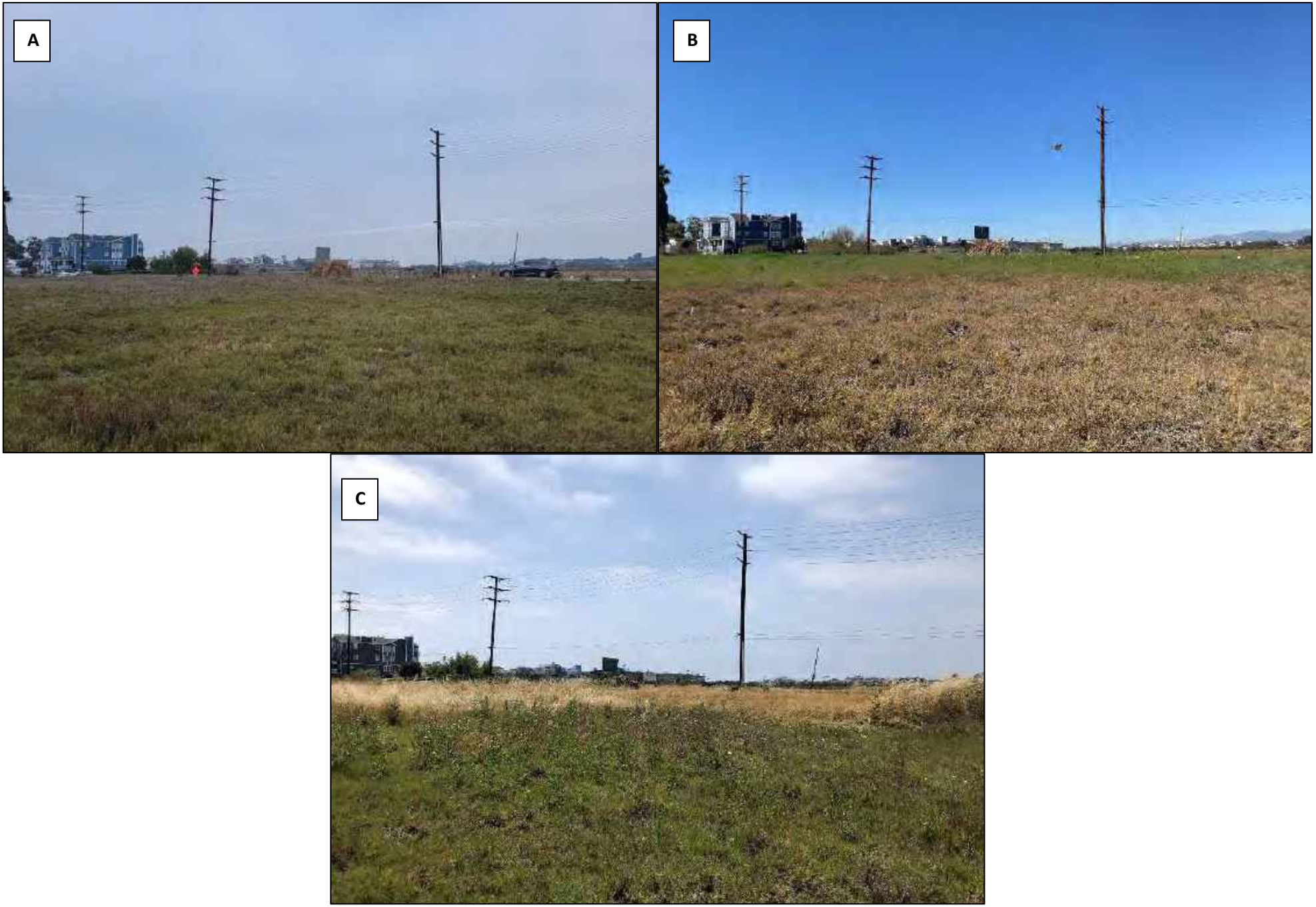

Figure A-28. Photo Point 5a at bearing 270° on (A) 17 November 2021; (B) 28 February 2022; (C) 03 June 2022.

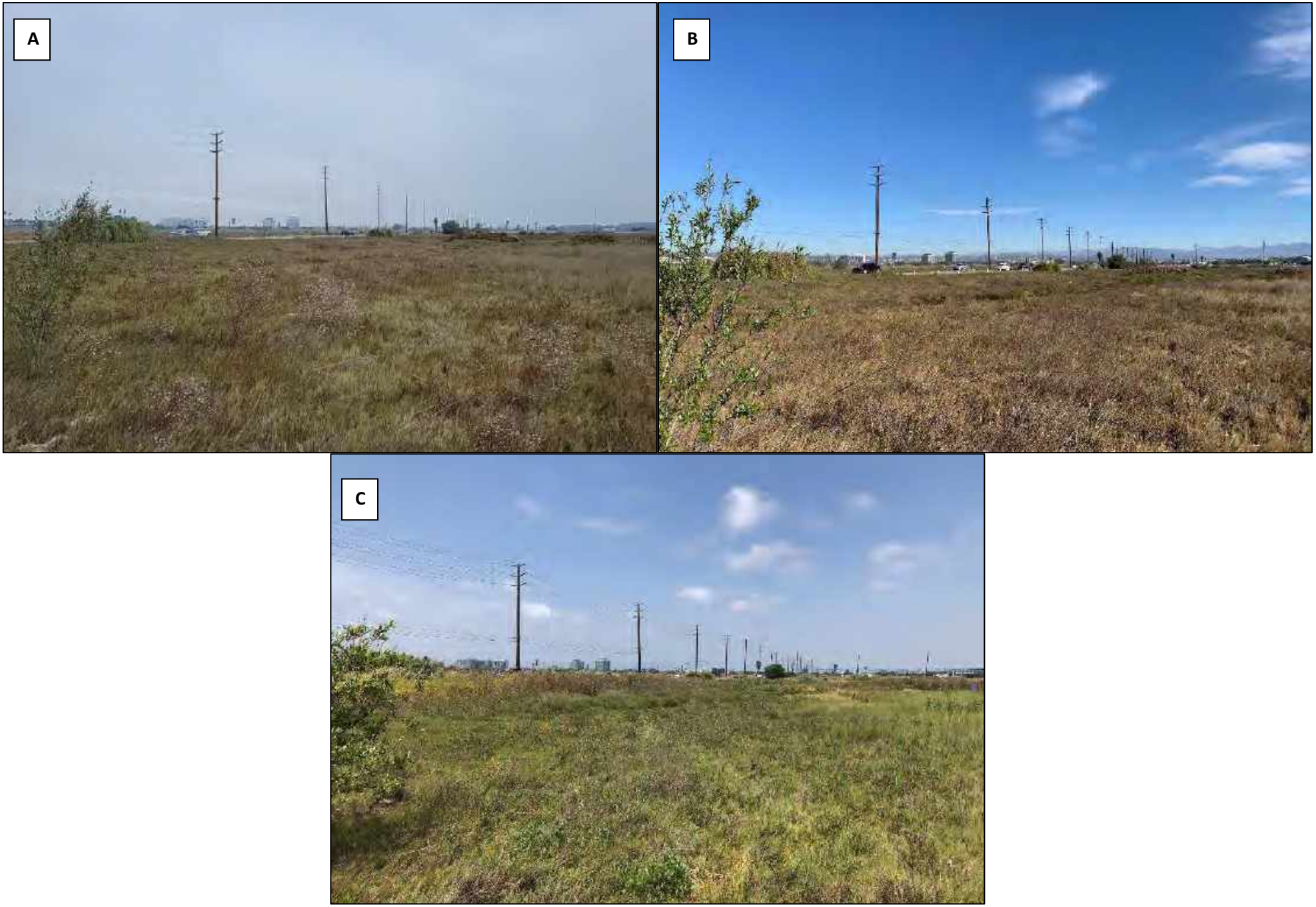

Figure A-29. Photo Point 5b at bearing 6° on (A) 17 November 2021; (B) 28 February 2022; (C) 03 June 2022.