RESTORATION ACTION PLAN

MARINA DUNES PRESERVE

Marina, California

Prepared for:

Monterey Peninsula Regional Park District
4860 Carmel Valley Road
Carmel, CA 93923

Prepared by:

Burleson Consulting Inc.
1900 Garden Road, Suite 210
Monterey, CA 93940

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BURLESON CONSULTING INC.
A Terracon COMPANY

ATTACHMENT 2

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ACRONYMS AND ABBREVIATIONS

2005 Plan	2005 Dune Habitat Restoration Plan for Marina Dunes Preserve
ac	acre/acres
BMP	Best Management Practice
Burleson	Burleson Consulting Inc.
ft	foot/feet
GIS	Geographic Information Systems
GPS	Global Positioning System
in	inch/inches
LiDAR	Light Detection and Ranging
MPRPD	Monterey Peninsula Regional Park District
Plover	Western snowy plover
Preserve	Marina Dunes Preserve
RA	Restoration Area
USFWS	United States Fish and Wildlife Service

1. INTRODUCTION

1.1 Setting

The Marina Dunes Preserve (Preserve) is a 62-acre property located adjacent to Monterey Bay on Dunes Drive in Marina, California (Figure 1). The Preserve is owned and managed by Monterey Peninsula Regional Park District (MPRPD). Historically, the property was mined for sand and is now dedicated open space. The coastal sand dunes within the parcel are part of the Monterey Dunes Complex which stretches along the Monterey Bay coastline from Salinas River State Beach to the Monterey harbor. The Preserve provides beach access from the end of Dunes Drive; however, the interior of the property is currently closed to the public for natural resource protection.

The property to the north of the Preserve is owned by CEMEX, a building materials company, and was used for sand mining until 2020. As ordered by a settlement agreement, the State of California directed that the property be purchased by a governmental or not-for-profit land conservation organization in the next few years, to preserve the land for environmental protection, habitat restoration, and public benefit. Future management decisions at the CEMEX property will potentially impact recreational use patterns at Marina Dunes Preserve. Additionally, sand deposition and dune dynamics will likely change due to the cessation of mining. To the east of the Preserve lies an RV park, to the southeast two hotels (one with RV parking), and to the south a beach resort. South of the beach resort is the Marina Coast Water District and Marina State Beach. The reliable presence of visitors due to the lodging establishments, proximity to the City of Marina, and potential increased access from the north coupled with the need to protect special status species habitat, requires thoughtful management of the Marina Dunes Preserve and its ecological resources.

Several threatened and endangered species can be found on or near the Preserve. Special status plant species include Yadon's wallflower (*Erysimum menziesii* ssp. *yadonii*), sand gilia (*Gilia tenuiflora* ssp. *arenaria*), and Monterey spineflower (*Chorizanthe pungens* var. *pungens*). Populations of Yadon's wallflower and sand gilia are limited but Monterey spineflower is found throughout the Preserve. Smith's blue butterfly (*Euphilotes enoptes smithi*) and black legless lizard (*Aniella pulchra nigra*) were last documented in 1997 (Dorrell-Canepa 2005). Western snowy plovers (*Charadrius nivosus nivosus*; plover) nest infrequently at the Preserve and are negatively impacted by humans, pets, and iceplant encroachment. However, they reliably nest at the CEMEX dunes to the north (K. Neuman, personal communication, December 9, 2020).

1.2 Purpose

In 2005, Native Solutions (Joey Dorrell-Canepa) developed the Dune Habitat Restoration Plan for Marina Dunes Preserve for MPRPD (Appendix A). The purpose of the plan was "to describe existing biological resources at [the Preserve] and to define procedures and standards for restoration of the native coastal landscape". Since 2005, many of the plan's recommendations have been implemented but efforts have had varying degrees of success, namely plantings have died or are stunted, and erosion continues to degrade habitat. In October 2020, MPRPD hired Burleson Consulting Inc., A Terracon Company (Burleson) to develop a dynamic, prioritized, three-year restoration action plan for the property that would update best management practices (BMP) put forth in the 2005 Plan and address areas that need further restoration. Restoration actions for the entire Preserve are listed in this plan and cannot feasibly be accomplished in three years. However, work has been prioritized so that MPRPD can achieve the most meaningful components of restoration in the near term. The overarching goal of Burleson's work

remains the same as in the 2005 Plan: “to improve native habitat value by increasing the quantity and diversity of native species as well as expanding the corridor of restored dunes around Monterey Bay”.

1.3 Approach

The majority of the restoration efforts at Marina Dunes Preserve were implemented between 2005 and 2016 and often independently completed by Native Solutions, inmate work crews, Return of the Natives volunteers, and Hope Services with oversight from MPRPD.

In order to assess current site status, Burleson conducted an in-depth field assessment accompanied by Christina McKnew, Restoration and Nursery Coordinator for Return of the Natives, who was involved in previous planting events. Field notes, global positioning system (GPS) data in the field, and MPRPD geospatial data were then used to delineate Restoration Areas (RA) for which specific restoration prescriptions were developed. All Preserve land was assigned an RA, even if the area requires little to no action so that MPRPD staff will be able to easily reference different locations as they adaptively manage the land in the near and long term.

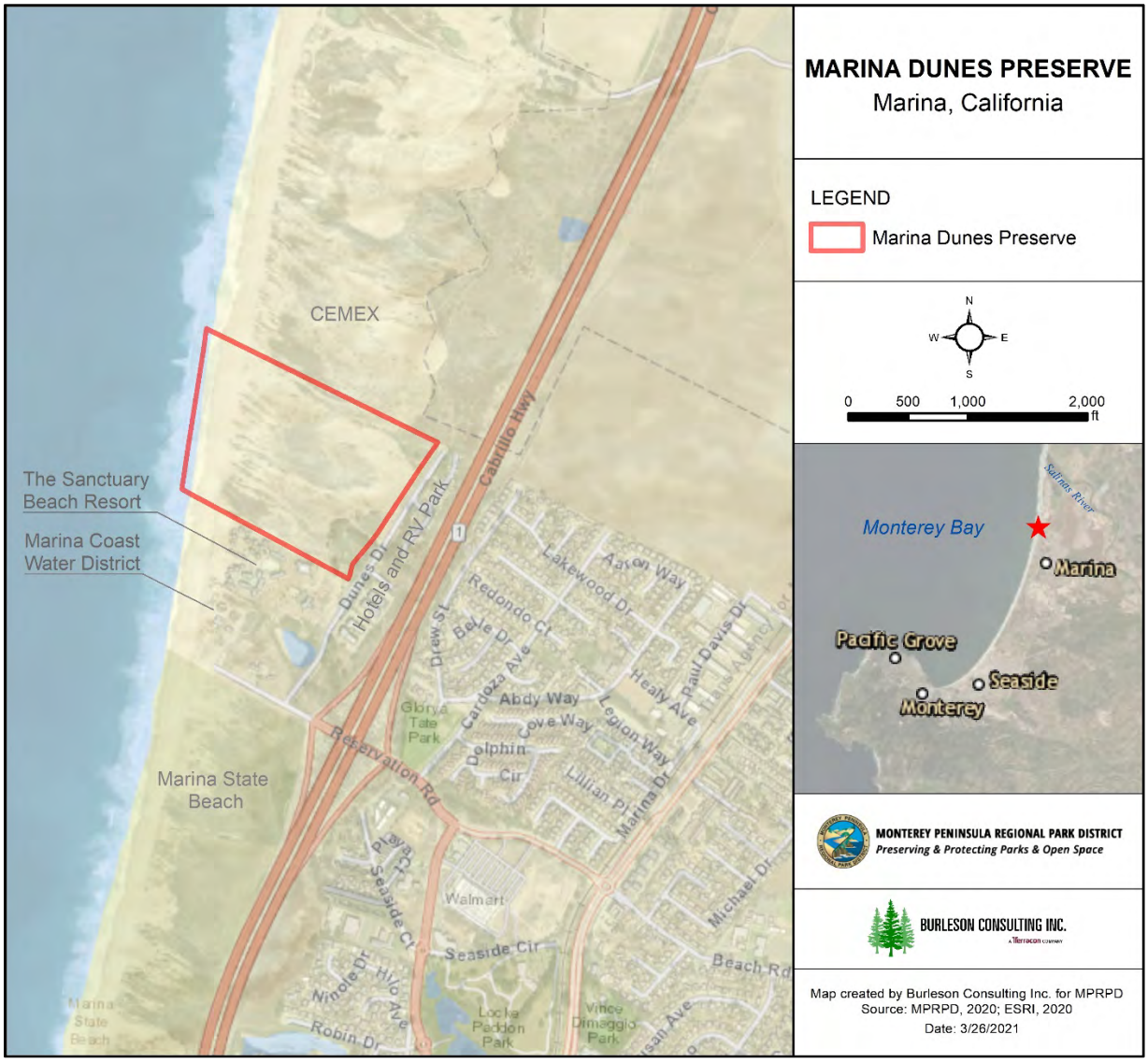

Figure 1. Location of Marina Dunes Preserve in Marina, California.

2. UPDATED BEST MANAGEMENT PRACTICES

The 2005 Dune Habitat Restoration Plan for Marina Dunes Preserve (2005 Plan) lists a variety of restoration prescriptions and best management practices for dune restoration. The current plan follows the BMPs in the 2005 Plan unless otherwise noted below. Burleson has made updates to the original BMPs and recommendations to ensure that MPRPD has the most current tools for successful restoration of the Preserve.

2.1 Weed Eradication and Control

The Preserve continues to host a variety of non-native species much like the surrounding dune landscapes. Iceplant (*Carpobrotus edulis*) remains the dominant invasive weed on the property and the non-native forest area in the Preserve's southeastern corner is the most highly impacted segment of the property.

A comprehensive update on invasive species was not performed for this plan due to seasonal constraints. However, two non-native species seem to have further established since the 2005 Plan was written. Narrow-leaved iceplant (*Conicosia pugioniformis*) occurs throughout the Preserve but most frequently along the northern access trail, in the central basin, and the rear dune area along Dunes Drive. Treatment should occur concurrently with iceplant. The 2005 Plan mentions a lone acacia (species unspecified) in the rear dune area near the non-native forest. As of 2020, there are now approximately three shrubs, identified by Burleson biologists as golden wattle (*Acacia longifolia*), in this area and one individual in the mid-to-foredune area south of the northern access trail. These shrubs are large and should be eradicated before the populations spread further. European beachgrass (*Ammophila arenaria*) is mentioned in the 2005 Plan as well but the population was not observed in fall 2020, though it may still occur on the property. This species is highly invasive and should be closely monitored to limit spread.

Burleson recommends a 2.5% concentration of glyphosate (with surfactant) when spraying iceplant and a 7% concentration when spraying European beachgrass. Acacia should be cut in the spring and stump treated with glyphosate concentrate. As recommended in the 2005 Plan, propagated plants should be planted in iceplant mulch six to twelve months after spraying. When pulling iceplant, plants should be turned root-side up and left in place to decompose. All other plan recommendations should be followed concerning weed eradication (Section 4, Appendix A). However, a permitted biologist should oversee hand-pulling of iceplant around the base of coast buckwheat plants to mitigate potential impacts to Smith's blue butterfly.

2.2 Sand Stabilization

Many of the plantings previously installed at the Preserve have not been successful due to inadequate sand stabilization. If sand is not sufficiently stabilized in the mid and rear dune areas, planting efforts will continue to be undermined. Therefore, aggressive measures to ensure sand accretion are warranted in most Restoration Areas.

Burleson recommends gradually removing and replacing the non-biodegradable sand stabilization materials currently found on the Preserve. All materials used in the future should be biodegradable and free of metal or plastic. Burleson does not recommend the following erosion control practices for Marina Dunes Preserve listed in the previous plan: straw planting or crimping, broadcast seeding, or hydroseeding. It is Burleson's professional opinion that straw crimping and hydroseeding are prohibitively expensive and yield varied results. Broadcast seeding may be used to augment plantings

but should not be considered a primary erosion control tactic at this site. The following are techniques that should be used as alternatives:

- Wood shims (Safe Harbor Environmental 2020)
    - This technique mimics sand accumulation benefits provided by plants.
    - Narrow cedar shims, measuring approximately 14 in long, are installed three to four inches into the sand, leaving about 10 in exposed.
    - Spacing between shims is 10 to 14 in.
    - Shims should be placed perpendicular to prevailing winds and in a four to six-foot-wide random matrix.
    - After significant storms or wind events, shims must be raised for continued sand accumulation.
    - Once treated areas show signs of stabilization, shims can be gradually replaced with propagated plants.
- Rows of wooden lath
    - This technique mimics sand fencing but does not require wire.
    - Lath, measuring three to four feet (feet or ft) in length, is driven into the sand to a depth of 12 to 18 inches (inches or in).
    - Spacing between individual pieces of lath is 1.5 to two inches to maximize sand deposition.
    - Rows are placed perpendicular to prevailing winds, spaced 10 ft apart for every one foot of vertical height (i.e., if lath has three feet of wood exposed above the sand, the next row should be placed 30 ft away).
    - Occasional staggered breaks in rows approximately six feet wide are made to allow free movement of wildlife.
    - After significant storms or wind events, lath must be raised for continued sand accumulation.
    - Wooden material used should be naturally resistant to rot and not treated with chemicals.
- Burlap sacks of sand
    - Burlap sacks filled with sand roughen the landscape and encourage sand deposition.
    - Burlap sacks should be filled and placed randomly across restoration areas.
- Coir fabric matting
    - In extremely eroded areas, coir fabric matting that allows for plants to grow through the spaces in the fabric can be used to stabilize soils and provide moist microclimates aiding in plant survival.
- Sterile straw bales
    - Sterile straw bales roughen the landscape like burlap sacks of sand but on a larger scale.
    - Straw bale placement is dependent on accessibility of a site as they are difficult to carry over long distances.
    - Any time a straw bale is placed, synthetic baling twine should be replaced with biodegradable twine.
    - All straw used should be sterile and certified weed-free.
- Sterile straw wattles
    - Straw wattles are useful in areas with minor erosion as sand accumulation is limited by the height of the wattle.

2.3 Seed Collection

Native plant seed for nursery propagation should be collected within three miles as recommended in the 2005 Plan to ensure genotypic fidelity. Given the dunes to the north have more intact stands of native vegetation, Burleson recommends concentrating seed collection efforts to the north of the Preserve if possible (permission from landowners will be necessary). Seed may be collected on the Preserve, but special care should be taken to ensure that seed is collected from plants that are indeed native, not native cultivars. A handful of plants on the Preserve appear to be variants on natives not appropriate for restoration purposes.

Before collecting seed from rare plants for propagation, rare plant surveys over the next few years are recommended to understand the extent of sand gilia and Yadon's wallflower. Monterey spineflower populations are healthy and do not require restoration. Once population dynamics are better understood, plans for restoration should be made. Seed collection from these species should only take place after consultation with United States Fish and Wildlife Service (USFWS) biologists. Seed collection from coast buckwheat plants, though not classified as rare or endangered, also requires consultation with USFWS and potentially a Section 10(a) permit due to potential incidental take of Smith's blue butterfly.

2.4 Outplanting

For this plan, areas on the Preserve are referred to as being within the fore, mid, or rear dunes. Foredunes are the most dynamic in terms of dune morphology and plants tend to be sparse, low-growing, and tolerant to burial by sand. Mid dunes are characterized by semi-stable dunes with high plant diversity and are comprised of mat-forming species and small shrubs. Rear dune areas are the most stable and are generally home to larger shrub species. Transition zones exist between each dune zone, but they vary in extent based on topography and microclimate. Burleson updated the list of recommended plants to be used in restoration at the Preserve according to the three dune zones, current scientific nomenclature, ease of propagation, and appropriateness for restoration (Appendix B). Approximate dune zones on the Preserve are depicted in Appendix C, Figure C-1.

2.4.1 Planting Targets

The 2005 Plan recommends approximately 1,000 seedlings per acre to supplement broadcast seeding. Burleson does not recommend broadcast seeding due to high winds and erosion at the Preserve. Once dunes are adequately stabilized with passive restoration techniques, plantings should be used to further stabilize sand and increase native plant cover and diversity. The following plant density targets (plants per acre) are appropriate for the three dune zones found on the property. If native cover already exists, planting densities should be reduced accordingly.

- Rear dune: 2,000
- Mid dune: 4,000
- Foredunes: 2,000

A target of two thousand (2,000) plants per acre in rear and foredune environments equates to approximately one plant for every two square meters. In the areas closest to the shoreline, this target should be reduced in order to avoid over-vegetating potential western snowy plover nesting habitat. Four thousand (4,000) plants per acre equates to approximately one plant per square meter in mid dune areas.

2.4.2 Special Status Species

As previously stated, Burleson does not recommend planting or seeding any of the special status plant species found on the Preserve until more information is known about population dynamics. However, near-term plantings should take rare or listed animal species habitat requirements into consideration.

The 2005 Plan recommends primarily planting dune buckwheat (*Eriogonum parvifolium*) to aid in Smith's blue butterfly recovery. Burleson recommends planting coast buckwheat (*E. latifolium*) instead of dune buckwheat for two reasons: coast buckwheat is currently the predominant buckwheat species on the property, and it is more regionally appropriate for the location. Dune buckwheat largely occurs from southern Monterey Bay to southern California while coast buckwheat occurs from central Monterey Bay to northern California. The site where Stilwell Hall once stood at Fort Ord Dunes State Park, approximately three miles south of Marina Dunes Preserve, marks the transition between the two species. It should also be noted that buckwheat requires moderate levels of disturbance to proliferate (R. Arnold, personal communication, March 24, 2021).

Recommendations in the 2005 Plan should be followed concerning enhancing western snowy plover and black legless lizard habitat. Generally, the legless lizard benefits from planting of shrub species like silver beach lupine and coast buckwheat. Plovers require first-successional beach environments for survival and reproduction. Research by Point Blue Conservation Science shows that western snowy plovers select nest sites in areas with 5-15% vegetative cover (Point Blue 2019). Therefore, foredunes should be minimally planted. Additionally, work should be limited to October through February in these areas to avoid impacts during the western snowy plover breeding season.

2.5 Public Access Policy

Burleson strongly recommends that MPRPD no longer allow dogs on or off-leash at the Preserve to protect special status species such as the western snowy plover and Smith's blue butterfly. This aligns with California State Parks' prohibition of dogs at its beach and dune areas at Marina State Beach. If dogs continue to be authorized, however, it is strongly recommended that access be strictly limited to dogs on leash only during times of the year when listed species are not breeding, nesting, or otherwise actively inhabiting the area. This would entail closing the Preserve to dogs from March 1st to September 30th every year. A seasonal closure would require regular enforcement. MPRPD could also use on-site personnel and a series of wildlife cameras to monitor unauthorized use. An alternative to closing the Preserve entirely to dogs would be to develop a dog park in the non-native forest area in the southeast of the Preserve.

2.6 Trails, Protective Fencing, and Interpretive Signage

Trails, fencing, and interpretive signage are essential to enhancing the public's experience, appreciation of nature, and sense of stewardship of public lands. Effective trails, fences, and signs are also instrumental in protecting and preserving the ecological integrity of an ecosystem. Various approaches are provided so that MPRPD can make dynamic decisions based on funding, management goals, and changing mandates.

2.6.1 Trails

Currently, the northern beach access trail is the only authorized trail on the Preserve. The southern access trail was closed over five years ago. One trail sufficiently accommodates visitors to the site though there are some signs of trespass at the start of the southern trail off Dunes Drive. Regulatory signage at this location attributes trail closure to western snowy plover protection. However, closing the northern trail would provide more benefit to western snowy plovers because the northern portion of

the Preserve is closer to nesting habitat on the CEMEX property (K. Neuman, personal communication, December 9, 2020). Depending on future management decisions on the CEMEX property, MPRPD may want to consider closing the northern trail and re-opening the southern trail to better protect plovers.

Several unauthorized trails within the central basin of the Preserve connect the closed southern trail to the northern trail. In the near term, trespassing should be controlled with increased signage, clear messaging, trail disguise using pulled iceplant, and patrolling. Visitors are drawn to exploring the interior of the Preserve; therefore, an opportunity exists to develop an accessible boardwalk trail that creates a low-impact walking loop with ocean views and overlooks through the central basin, connecting the northern and southern trails. Opening more authorized trails, however, increases potential for trespassing. If MPRPD would like to construct this trail in the future, precautions must be taken to control trespassing and mitigate effects on western snowy plover and Smith's blue butterfly.

2.6.2 Fencing

Current fencing on the Preserve is moderately effective in controlling where visitors walk and protecting natural resources. Most of the public appears to use the northern access trail, but signs of regular trespass exist throughout the property. At least three major trespass points exist along the southern fence line of the northern access trail, footsteps show that people often walk under the symbolic fencing on the beach onto the foredunes, erosion on the southern coastal cliffs suggests frequent foot traffic, and the southern access trail is occasionally used due to a compromised fence in the northwestern corner of the non-native forest. Little to no trespassing seems to be occurring from the south. All fences are intact except for the fence on the perimeter of the non-native forest, which should be repaired. The fact that fences are largely intact suggests that updated interpretive signage and increased enforcement may be the best tools to encourage visitors to stay on the authorized trial(s).

2.6.3 Interpretive Signage

Dune ecosystems are complex, dynamic, and ecologically diverse, creating opportunities for public engagement, enrichment, and enjoyment. MPRPD should consider an interpretive signage program for the Preserve as all signs need to be updated. The goals of this program would be to enhance visitor experience, increase educational opportunities, foster a sense of stewardship, and effectively communicate rules so that natural resources are protected.

Burleson recommends convening a working group comprised of MPRPD board members and/or staff, scientific illustrators, and communications specialists to determine updated signage needs, content, design, and timeline for installation. The highest priority is creating consistent messaging as rules and directions listed on current signs contradict one another. For example, one sign along Dunes Drive reads "Public access to the beach is provided at the north and south entrances" but the sign at the southern entrance reads "This beach access has been closed to protect endangered snowy plover nesting. Please use the north entrance". Other signs are difficult to read from the trail and some convey out-of-date information. See Appendix D for photos of current signs to inform future updates.

The working group should take the following into account when developing signage:

- Clearly articulate unauthorized activities
- Make signs legible from a distance, simple, clear, and consistent
- Develop content that remains current no matter the year and represents the most current science
- Showcase restoration efforts
- Create and install signs prior to or during restoration efforts

- Consider a large, three-paneled kiosk at the entrance to the northern access trail to maximize the amount of information to be conveyed
- Consider how the potential sale of the CEMEX property will impact use patterns or trail development on the Preserve, and therefore signage
- Use existing infrastructure as much as possible for sign installation
- Consider signage which directs people to approved paths and away from trespassing areas (i.e., along the southern fence line of the northern access trail)
- Convey ocean safety information
- Remove old signs when new ones are installed
- Develop cost estimate
- Consider working with the California State University, Monterey Bay Science Illustration program to develop interpretive signs

2.7 Miscellaneous

Three recommendations in the 2005 Plan are either no longer applicable or Burleson considers them low priority: removal of construction debris, sand recontouring and augmentation, and gopher and ground squirrel eradication. Removal of construction debris appears to have either already occurred or debris has been buried by sand. Cement platforms remain on the bluff by the northern access trail outlet and in the maritime chaparral habitat just south of the start of the trail, but do not pose a significant threat to human safety. Sand recontouring and augmentation is not warranted at this time because native vegetation has established in the areas suggested as sand sources. Gophers and ground squirrels continue to be an issue in the non-native forest and maritime chaparral habitats, but Burleson does not recommend using phos-toxin gas or rodenticide to control their populations to avoid risks in impacting other species. The populations do not appear to have expanded since the 2005 Plan was written, and native plants in the surrounding areas do not seem to be under more herbivory pressure than other parts of the Preserve, warranting no action at this time.

3. PRIORITIZED RESTORATION RECOMMENDATIONS

The following section prioritizes restoration actions by area on the Preserve. Restoration Area (RA) boundaries were chosen based on topographical features and plant community types observed in fall 2020 (Appendix C, Figure C-1). The boundaries were digitized using ArcGIS software and should be used as general guidelines, not definitive areas, during implementation. All Preserve land was assigned to an RA, even if the area requires little to no action, so that MPRPD staff will be able to easily reference different locations as they adaptively manage the land.

Restoration prescriptions were developed for each RA by reviewing historic reports, interviewing past and present restoration collaborators and MPRPD staff, reviewing MPRPD geospatial data, and visiting the site to gauge efficacy of previous work. Restoration Areas and site-specific restoration actions are listed below in order of priority. Priority actions should be considered dynamic guidelines for enhancing the Preserve; thus, many approaches have been presented to accommodate budget constraints and timelines. Detailed maps of each RA are provided in Appendix C, showing approximate locations in which rear, mid, and foredune species should be planted when applicable. Dune zones were digitized using ArcGIS based on observations made in the field in fall 2020. Photos of current site conditions are provided in Appendix E and a five-year schedule and budget for highest priority actions are provided in Appendix F.

3.1 Restoration Area 1

The land to the immediate south of the Preserve's northern beach access trail is the only part of the Preserve that has a continuous succession of primarily native plant species from the rear dunes to the foredunes. As the northern trail is the only authorized access point to the Preserve at this time, this is the landscape that visitors will interact with the most. Iceplant can be found throughout in small patches along the southern fence line but can be treated easily, creating an ideal opportunity to showcase restoration efforts and improve habitat.

Restoration Area 1 comprises approximately 2.9 acres (acres or ac) of primarily mid dune habitat and includes the majority of the northern access trail. The RA should be considered to have two subareas, one to the south of the fence (Subarea A) and one to the north (Subarea B) (see Appendix C, Figure C-2). Prescriptions are largely the same for each subarea, but Subarea A should be given priority when planning work in the immediate future.

3.1.1 Priority Actions

3.1.1.1 RA-1 Subarea A (1.9 ac)

- Weed eradication. Spot treat and/or pull iceplant starting closest to the ocean and working back to the rear dune. Remove single golden wattle shrub (*Acacia longifolia*) to prevent future spread (see map for location). Follow up with spot treatment/pulling of all weeds as needed.
- Planting. Starting closest to the ocean, plant in previously treated, dead iceplant mulch and work back to the rear dune. Some steeper areas exist towards the foredunes which may not be appropriate for volunteer groups. During planting events, social trails should be disguised using hand-pulled iceplant.

  Planting Targets (number of plants)
  - Mid dune: 2,000

3.1.1.2 Interpretive Signage

- Existing interpretive signs along the northern access trail are outdated and some are hard to read. There are approximately three major unauthorized social trails traveling south to the center of the Preserve from the authorized trail. Signs should have consistent messaging about restoration efforts and closed areas. Signs should be installed as soon as possible after planting events, using existing infrastructure.

3.1.1.3 Ownership

- According to the County of Monterey's land parcels geospatial data (County of Monterey 2019), the Preserve's northern property boundary ranges from 10 to 65 ft from the northern access trail fence line. Subarea B is located between the property boundary and the fence line. Therefore, verification that MPRPD indeed owns the land to the north of the trail is needed before work commences in Subarea B.

3.1.1.4 RA-1 Subarea B (0.7 ac)

- Weed eradication. Spot treat and/or pull iceplant starting closest to the ocean and working east. Follow up with spot treatment/pulling as needed.
- Planting. Starting closest to the ocean, plant in dead iceplant mulch and work east.

  Planting Targets

- Mid dune: 2,520

3.2 Restoration Area 2

Restoration Area 2 encompasses the central basin of the Preserve which covers approximately 9.4 acres. It is characterized by stabilized dunes and one of the largest continuous coast buckwheat populations on the property, though most plants are small in size. Many iceplant patches have partially died either due to frost damage or past herbicide application and provide an immediate opportunity for planting. The very western edge of the basin, along the backside of the foredunes, is potential western snowy plover nesting habitat. Therefore, before performing weed eradication and planting activities between March 1st and September 30th, a qualified biologist should be consulted to avoid impacting nesting plovers. Smith's blue butterfly also likely occurs here, so any weed treatment in the basin should not be conducted during the flight season (June – August). Additionally, anyone contributing to restoration efforts in the area should be trained in dune buckwheat identification so that plants are not trampled, and the dripline of each plant remains undisturbed throughout the year (as larvae often fall to the ground).

Restoration Area 2 has been divided into two subareas to guide implementation activities. Subarea A lies to the north and east of the basin center. It is characterized by relatively low levels of iceplant and can be planted in the near-term without weed treatment. Subarea B encompasses the basin center and will require spot spraying or hand pulling of iceplant prior to planting (see Appendix C, Figure C-3).

3.2.1 Priority Actions

3.2.1.1 RA-2 Subarea A (4.8 ac)

- Planting. Plant mid dune species directly in existing, dead iceplant mulch. This is an ideal area to focus on planting coast buckwheat to enhance Smith's blue butterfly habitat.

  Planting Targets
  - Mid dune: 6,720

- Weed eradication. Spot treat and/or pull iceplant as needed. The most vigorous iceplant populations in this subarea currently occur close to the crest of the dune to the southeast.

3.2.1.2 RA-2 Subarea B (4.6 ac)

- Weed eradication. Spot treat and/or pull iceplant in the central basin.
- Planting. Plant mid dune species directly dead iceplant mulch. This would also be an ideal area to focus on planting coast buckwheat to enhance Smith's blue butterfly habitat.

  Planting Targets
  - Mid dune: 11,040

3.3 Restoration Area 3

Restoration Area 3 is a 3.2-acre sand sheet in the northwest portion of the Preserve (see Appendix C, Figure C-4). The northern portion is highly impacted by foot traffic as it includes the outlet of the northern beach access trail, the central area has been previously planted with limited success, and the eastern portion is a blowout (unstable/eroded sand dune) with very sparse vegetation. Erosion control measures currently in place are comprised of plastic drift fencing and are either failing or providing limited sand accumulation benefit.

The western outlet of the northern access trail is set back from the beach at this location and is likely contributing to erosion across RA-3. The lack of symbolic fencing directing people to a single access point on the beach allows consistent, spread-out trampling of the dunes, highly impacting approximately 0.75 ac and preventing sand accumulation. The highest priority for the RA is to limit trampling and encourage sand accumulation.

A qualified western snowy plover biologist should be consulted prior to implementing any restoration activities in this area. Rare plants also occur in within RA-3, including planted Yadon's wallflower and naturally occurring Monterey spineflower. A spring survey should be conducted to locate populations and minimize impacts during restoration. Burleson does not recommend actively planting or seeding rare plants until population dynamics are better understood across the Preserve.

3.3.1 Priority Actions

3.3.1.1 Sand Stabilization

- Install mosaic of straw bales, burlap sacks of sand, and/or lath in the area surrounded by the newly placed symbolic fencing. Visit site periodically to raise lath as sand accumulates.
- Remove and replace plastic drift fences to the east of the existing symbolic fencing with sand fencing made of lath (without wire). Occasional staggered breaks in the fence should be made to allow free movement of wildlife. After significant storms or wind events, visit site to raise wood lath as sand deposits and accumulates.
- Between rows of lath, install a mosaic of wood shims, burlap sacks of sand, and/or straw bales. This matrix will protect the deposited sand from crosswinds.

3.3.1.2 Rare Plant Surveys (Annual)

- Survey and map Monterey spineflower during the month of May.
- Survey for Yadon's wallflower in early summer.

3.3.1.3 Fencing

- Install symbolic fencing pathway to extend the northern access trail outlet to one single point farther down on the beach (below bluff). Angle trail south, following existing symbolic fencing. Continue new symbolic fence line to the north along the base of the bluff and back to the northern fence line of the main trail. See map for approximate placement.

3.3.1.4 Interpretive Signage

- Place interpretive signs on, or in immediate proximity to, symbolic fences to minimize trespass and garner support for restoration efforts. Include signs that make the beach exit/entry location clear.

3.3.1.5 Planting

- Plant in dunes once sand has stabilized (after approximately 2 years). Planting of foredune species should be minimal to maintain favorable plover nesting habitat. Planting of mid dune species should be adequately set back from the active dune area.

  Planting Targets
  - Foredune: 2,000
  - Mid dune: 2,400

3.4 Restoration Area 4

Restoration Area 4 is comprised of primarily rear dune, maritime chaparral habitat in the northeastern corner of the Preserve (see Appendix C, Figure C-5). Planting in this two-acre area is not advised at this time as the existing shrubs are mature and healthy. Treating iceplant in this location, however, is essential to protect adjacent plantings RA-1 and RA-5 from weed encroachment. Updating interpretive signs at the start of the northern access trail in the northeast corner of RA-4 is warranted to provide clear messaging to visitors regarding allowable activities and local ecology. As previously noted, Burleson strongly recommends that MPRPD no longer allows dogs at the Preserve to protect special status species. However, if dogs continue to be authorized at the Preserve, it is strongly recommended that access be strictly limited to dogs on leash only during those times of year when listed species are not breeding, nesting, or relying on the area.

3.4.1 Priority Actions

3.4.1.1 Interpretive Signage

- Update kiosk signs at the start of the northern access trail with interpretive and regulatory language regarding restoration efforts and allowable activities. Consider large, three-sided kiosk to maximize space for information being presented.

3.4.1.2 Weed Eradication

- Dense mats of iceplant should be sprayed and monitored. Follow-up treatments will likely be necessary.
- Monitor and manage colonization of invasive annual grasses after spraying.
- Consider removing non-native cypress trees and monitor for and remove sapling growth.

3.5 Restoration Area 5

Restoration Area 5 is the largest sand sheet on the Preserve. It covers five-acres and has been planted multiple times (see Appendix C, Figure C-6). Most plantings have failed, but the plants that persist are generally stunted and wind has scoured around their roots. Erosion control efforts have had varying success, with efforts being more successful towards the rear dune. Erosion control materials present at the site include crimped straw, plastic drift fencing, and wood and metal sand fencing. The highest priority for this RA is sand stabilization. Plantings will most likely not be effective until after adequate sand has stabilized (after approximately two-years post erosion control installation).

3.5.1 Priority Actions

3.5.1.1 Sand Stabilization

- Gradually remove all non-biodegradable sand stabilizing materials throughout the site and immediately replace with biodegradable materials like wood lath, wood shims, burlap sacks of sand, coir fabric matting, straw bales, and straw wattles.
- Install wood lath rows at the start of the western-most blowout and at the smaller, southern blowout (see map). Occasional staggered breaks in the lath rows should be made to allow free movement of wildlife. Between rows, install a mosaic of wood shims, burlap sacks of sand, and/or straw bales. Visit site periodically to raise shims as sand accumulates.

3.5.1.2 Trash Removal

- Remove non-biodegradable trash from site including old plant pots and baling twine from previous restoration efforts.
- Without compromising stable sand, carefully remove metal poles and unnecessary wires.

3.5.1.3 Planting

- Plant in dunes once sand has stabilized (after approximately two years).
- This is a very large RA with very little vegetative cover. Plantings will need to be installed over several years to revegetate the area.

  Planting Targets
  - Mid dune: 19,000

3.5.1.4 Weed Eradication

- Spot treat and/or hand pull iceplant as necessary once dunes stabilize.

3.6 Restoration Area 6

Restoration Area 6 is a 0.7-acre, narrow blowout to the north of the ridge above the closed southern access trail (see Appendix C, Figure C-7). Some plastic drift fencing is present at the site and previous restoration plantings are predominately dead or considerably scoured. Sand stabilization is the highest priority action in this location.

3.6.1 Priority Actions

3.6.1.1 Sand Stabilization

- Remove and replace non-biodegradable sand stabilization materials. Install lath and wood shim matrices to the west at the start of the blowout. Visit site periodically to raise lath and shims as sand accumulates.

3.6.1.2 Planting

- Plant mid dune species on stable islands and expand existing clusters of native plants. Blue dune grass is doing well here and could be used for propagation.
- Plant in dunes once sand has stabilized (after approximately 2 years).

  Planting Targets
  - Mid dune: 2,400

3.6.1.3 Weed Eradication

- Spot treat or hand pull iceplant as necessary once dunes stabilize.

3.7 Restoration Area 7

Restoration Area 7 (2.9 ac) is similar to RA-5 and RA-6 as it includes sand sheets and blowouts (see Appendix C, Figure C-8). The site has been planted multiple times and erosion control measures on site include wood and metal sand fencing, plastic-netted straw waddles, and plastic drift fencing. Wood and metal sand fencing in the western portion of the site was placed in a zigzag pattern parallel to prevailing wind patterns. Sand accumulation behind this fencing is limited, suggesting that in the future, erosion control materials should be placed perpendicularly to prevailing winds. In the eastern portion of RA-7, waddles and plastic drift fencing placed in a north to south direction have been successful at stabilizing sand and have mostly reached their sand stabilization potential. Previous plantings in the middle of the site have been moderately successful but in other areas roots are exposed and plants have died or are stressed and stunted.

The most extensive erosion in the western portion of the site appears to stem from a blowout between RA-6 and RA-7. Sand fencing placed in a north-south fashion (perpendicular to prevailing winds) at the

crest dividing these two RAs has been successful, however the northern end of the fence is compromised, allowing for erosion to continue. There are approximately three smaller blowouts along the northern perimeter of the site which also need to be addressed.

3.7.1 Priority Actions

3.7.1.1 Trash Removal

- Remove non-biodegradable trash from site including old plant pots. Plant pots were left on site after previous plant installation to mark location of plantings.

3.7.1.2 Sand Stabilization

- Expand current sand fencing with wood lath (without wire) and a matrix of wood shims between RA-6 and RA-7 to span the entire blowout. Zigzag fencing at this location is functioning; consider leaving wooden fence in place and removing metal poles. Visit site periodically to raise lath and shims as sand accumulates.
- Install wood shim matrices on eastern side of all blowouts. Visit periodically to raise shims as sand accumulates.
- Gradually remove and replace non-biodegradable sand stabilization materials to the east of the blowout with wood shim matrices and burlap sacks of sand. Install straw bales if feasible.

3.7.1.3 Planting

- Plant in dunes once sand has stabilized (after approximately 2 years). Planting may occur in currently stabilized areas and along RA edges in the near-term but is low priority.

  Planting Targets
  - Mid dune: 9,280

3.7.1.4 Weed Eradication

- Spot treat iceplant as necessary once dunes stabilize.

3.8 Restoration Area 8

Restoration Area 8 covers the majority of the Preserve's foredune area. The 6.9 acres are characterized by numerous large blowouts and dune ridges with dense mats of iceplant intermixed with native foredune species (see Appendix C, Figure C-9). Restoration in this area must be carefully planned and executed to enhance and maintain western snowy plover habitat. Plovers require first-successional beach environments to feed and reproduce. Therefore, densely planting the foredunes and stabilizing all blowouts is not advisable. Work in this area should be limited to October through February to avoid impacts during the breeding season unless a qualified western snowy plover biologist has verified that restoration activities would not negatively affect the plovers. The highest priority actions to enhance western snowy plover habitat in this area are to treat iceplant, replace it with native species, and prevent further human trespassing to minimize dune erosion. Some of the smaller blowouts could be treated with wood lath and shim matrices to help stabilization as long as other blowouts remain open for chicks to seek refuge in. A qualified plover biologist should be consulted prior to implementing any restoration activities in this area to avoid altering dune topography near previous nest sites.

3.8.1 Priority Actions

3.8.1.1 Interpretive Signage/Control Trespass

- Consider extending symbolic fencing towards ocean to make dune access further away and less appealing/convenient to visitors (this has been successful at Monterey State Beach). Feasibility of this suggestion depends on high-tide lines and winter wave runup.
- Remove existing signs hanging on symbolic fencing and replace with clear, consistent messaging. Remove all "dogs on leash" signs with signs that say something similar to "No dogs allowed - snowy plover habitat", as applicable.

3.8.1.2 Weed Eradication

- Gradually spray iceplant mats, starting in the north and working south. Spray one to two ridges initially and monitor for approximately one year to assess dune response. Continue spraying ridges to the south in subsequent years if no erosion issues have developed due to spraying.

3.8.1.3 Planting

- Minimally plant foredune species into dead iceplant mulch. Low-growing, low-cover species should be planted closest to the beach and foredune species with higher vegetative cover should be planted to the east.

  Planting Targets
  - Foredune: 4,140

3.8.1.4 Sand Stabilization

- Use wood shim matrices to stabilize sand in a few of the smaller blowouts and monitor for effectiveness. Visit site periodically to raise shims as sand accumulates.

3.9 Restoration Areas 9 – 13

Restoration Areas 9 – 13 are lower priority areas where restoration will likely not happen for at least three years. They have been grouped here to provide management considerations for future planning See Appendix C, Figures C-10 through C-13 for maps of the RAs. No map was made for RA-13 as all relevant information is conveyed in Appendix C, Figure C-1.

3.9.1 Restoration Area 9

Restoration Area 9 comprises eight-acres of mid and foredune habitat along the southern boundary of the Preserve. RA- 9 is separated into two Subareas, A (2.2 ac) and B (5.8 ac) and is generally characterized by frequent patches of iceplant and relatively small native plants. Coast buckwheat can be found throughout the RA though plants are not robust. Subarea A encompasses the largest continuous iceplant population on the Preserve in the southwest of the property. Subarea B stretches from the non-native forest in the east (RA-12) to the start of Subarea A. A sand gilia population occurs close to the border with RA-12, though population dynamics are not well understood. The following restoration activities should be considered in future years:

- Rare plant survey:
  - Survey and map sand gilia population in Subarea B in early to mid-April for two or three years.
- Weed eradication:
  - Focus on Subarea A dense iceplant with follow up spot treatment.

    - Spot treat iceplant from east to west in Subarea B, hand pull around sand gilia and consider removal of non-native trees.
- Sand stabilization:
    - Place burlap sacks of sand and/or wood shims in eroded areas.
    - Consider disguising and rehabilitating closed southern access trail.
- Planting:
    - Plant mid and foredune species in Subarea A and mid dune species in Subarea B.

3.9.2 Restoration Area 10

Restoration Area 10 lies directly north of the presently closed, southern access trail. The eastern portion of the 1.7-ac site has been planted and iceplant was previously pulled by volunteers. Good native plant diversity exists on this slope, suggesting that iceplant control is the highest priority. The current recommendation is further weed eradication especially in the western portion of the RA.

3.9.3 Restoration Area 11

Restoration Area 11 is located along the western boundary of the Preserve property line. The area comprises 1.8 acres with good natural recruitment from multiple planting efforts and patches of iceplant peppered throughout. New plantings are a low priority. The following actions should be considered in future years:

- Land ownership:
    - Clarification with regard to land ownership is needed before any work commences; the Preserve property line falls approximately 50 ft - 60 ft west of the eastern fence line according to County of Monterey land parcels data.
    - Consider a formalized access agreement with the City of Marina.
- Weed eradication:
    - Consider: iceplant maintenance, golden wattle removal (there are currently approximately three of the shrubs on site), monitoring and treating non-native annual grasses, and possibly removing non-native cypress.

3.9.4 Restoration Area 12

Restoration Area 12 is south of RA-11 and east of RA-9 in the southwest corner of the Preserve. It contains 3.2 acres of highly impacted habitat. Eucalyptus, iceplant, and cypress are the dominant species. The non-native forest attracts crows and ravens which may increase the chances of western snowy plover predation on the beach. The area is sometimes used by the homeless as the cypress trees along Dunes Drive provide shelter from the elements. This area has multiple use options that are still under consideration and dependent on a variety of factors not discussed in this plan. Habitat restoration is unlikely to be the best use of this area given the level of disturbance, proximity to the road, and the possibility of future low impact development. Updated trail closure signs should be installed when new signs for the Preserve are developed if this area remains closed to public access. Future infrastructure may include a picnic area, dog park, or a small operations center. Ideally, these options would increase park accessibility to limited-mobility individuals and provide a more ecologically sensitive solution for visitors with dogs if dogs are not allowed on other parts of the Preserve. Before any work commences, clarification with regard to land ownership in the eastern portion of the RA is needed along with a better understanding of the extent of the adjacent sand gilia population in RA-9.

3.9.5 Restoration Area 13

Restoration Area 13 is the beach portion of the property stretching from the base of the foredunes to the high tide line. The 2.4-acres do not require any restoration effort at this time; however, beach cleanup and possible extension of exclusion fencing to protect dunes from erosion to benefit western snowy plover habitat should be considered.

4. COMMUNITY ENGAGEMENT

The Preserve presents many opportunities for community engagement due to its location, popularity amongst locals, and ecology. Outplanting and "weeding days" hosted by organizations like Return of the Natives, provide meaningful ways for youth and the public to become stewards of their public land. Inviting university students to monitor restoration efficacy provides a sense of pride and empowerment when their work is used to inform land management decisions. With a sense of ownership for the Preserve, more people will advocate for its protection.

Appropriate projects for the public include planting, non-technical erosion control, weeding, and beach clean-ups. Relationships with California State University, Monterey Bay and Monterey Peninsula College can be strengthened to engage undergraduates in monitoring efforts and graduate students in development of interpretive signs or long-term research projects.

Teaching points when people are visiting the interior of the Preserve include:

- Natural history: habitat requirements of rare plants and animals
- Human history: Indigenous inhabitants, mining operation history, human behavior today (behaviors that threaten dune habitats and restoration efforts), balancing public use and habitat restoration
- Solutions: what people can do to help the dunes
- Geomorphology of the Monterey Bay Area
- Rules/guidelines while at the Preserve:
    - Preserve rules
    - Rules specific to work tasks (safety, avoidance of stepping within the dripline of coast buckwheat to minimized impacts to Smith's blue butterfly pupae, etc.).

5. MONITORING, MAINTENANCE, AND ADAPTIVE MANAGEMENT

5.1 Restoration Efficacy Monitoring

Monitoring the success of plantings and dune stabilization efforts at the Preserve is essential for developing adaptive management strategies. Because dune systems are dynamic and ecologically variable depending on microclimates, Burleson recommends an "ecosystem approach" to assessing restoration success. Quantitative performance targets for native plant ground cover and species richness should be used to guide restoration activities, but success should ultimately be determined by assessing a variety of factors which include but are not limited to increases in native plant ground cover, species richness, sand accretion, and non-native species control (especially iceplant).

5.1.1 Performance Targets

The following performance targets outline general goals for restoration. They should not be considered strict criteria for determining success.

Burleson recommends aiming to achieve the percent native plant cover targets listed in Table 1. After five years, foredune cover should be no greater than 15% to align with western snowy plover nesting requirements. Mid dune cover should be greater than 20% and rear dune cover should be greater than 25% (Burleson professional opinion). Non-native cover should be maintained below 10% after treatment.

Table 1. Updated Percent Native Cover Performance Targets.

Dune Zone	5-Year Native Percent Cover Targets
Foredune	<15%
Mid Dune	>20%
Rear Dune	>25%
Non-native species	<10%

5.1.2 Monitoring Approach

5.1.2.1 Revegetation

Burleson recommends establishing repeatable transects and strategic photo-monitoring point locations within each RA prior to planting. Sturdy wooden posts (2 in x 2 in x 48 in) with a metal screw fastened on top will be used to mark the start and end points of transects and photo monitoring points. The metal screw allows for detection with a metal detector in case of sand burial. These posts may need to be periodically raised due to burial by sand. The goals of monitoring are to gauge the success of plantings and efficacy of invasive species treatment and to determine areas in need of follow-up actions.

Fifty-meter transects will be randomly placed within restoration areas perpendicular to the coastline at a frequency of approximately one transect per acre. Point-intercept monitoring (at every 0.5 m) will be used to determine vegetative cover and belt monitoring (five feet on either side of the transect) will be conducted to assess species richness. Monitoring should take place between late April and early June (ideally May) every other year for five years. Baseline data will be collected in Year 0 prior to planting, Year 1 data collected the following year, Year 3 data two years after Year 1, and Year 5 data two years after Year 3. Qualitative data will also be taken during each monitoring event to identify any problem areas or areas that need adjustments to restoration prescriptions. A template with monitoring instructions and a reporting format will be developed in May 2021.

5.1.2.2 Dune Stabilization

During spring monitoring, the status of erosion control materials will be qualitatively assessed and documented as part of the vegetation monitoring report. Longer-term monitoring of sand accretion is also recommended.

Dune profiles can be monitored to determine the effectiveness of sand stabilization efforts over time. Multiple, repeatable transects stretching from the rear dune to the foredune are established across a given area and are either monitored using on-the-ground surveying methods or remote sensing (Labuz 2016). Burleson recommends monitoring dune morphology at the Preserve using remote sensing techniques approximately every five years once erosion control measures are implemented. This entails collecting LiDAR (light detection and ranging) data, transforming it into a digital elevation model, and using the Profile Graph tool in ArcMap to compare profiles between years (J. Schweisinger, personal communication, January 15, 2020). Comparing profiles between sites will help determine the most effective sand stabilization techniques for the property. The last aerial imagery of the Preserve was collected in 2019 and should be repeated in 2024 or 2025.

5.2 Special Status Species Monitoring

Little is known about the current populations of special status species on the Preserve. Threatened and endangered plants and animals were last monitored in 2005 and 1997, respectively (Dorrell-Canepa 2005). A better understanding of current population dynamics is required to develop targeted species recovery actions that are cost effective and based on sound science. Though some suggestions for monitoring special status species on the Preserve were previously mentioned in this plan, the following is a synthesis of suggested monitoring efforts:

- Yadon's wallflower: Yadon's wallflower should be monitored in summer 2021, 2022, and 2023 (it blooms from May to September). Individuals should be counted, and population extents mapped.
- Sand gilia: Historic populations of sand gilia should be monitored in the spring for at least the next three years. Individuals should be counted, and population extents mapped. The population most likely will be in peak bloom around the second or third week of April, but multiple site visits before and after will aid in detection. Anecdotal evidence suggests that the sand gilia populations on the Preserve are declining (F. Watson, personal communication, December 4, 2020).
- Monterey spineflower: No monitoring of Monterey spineflower is needed at this time. Populations are plentiful and extensive on the Preserve.
- Smith's blue butterfly: perform at least three presence/absence surveys, one at the beginning, middle, and end of the Smith's blue butterfly flight window (mid-June to early August) in summer 2021 and 2022. If the butterflies are not found during monitoring efforts, continue annual monitoring and work with USFWS to develop appropriate reintroduction actions if determined extirpated.
- Black legless lizard: since black legless lizards live most of their lives in the sand, monitoring can be difficult and disruptive to the animals. Instead of monitoring, Burleson suggests planting shrubs like silver beach lupine, mock heather, and coast buckwheat in mid-to-rear dune areas to enhance habitat.
- Western snowy plover: partner with Point Blue Conservation Science to track western snowy plover activity on the Preserve and work with Point Blue biologists to ensure land management decisions are in alignment with plover habitat requirements.

5.3 Maintenance and Adaptive Management

MPRPD requested a two-year follow-up maintenance plan to guide Preserve management after three years of restoration. Appendix F can be used as a guide for short-term and long-term planning. The beneficial impacts of three years of restoration are dependent on level of effort, quality of work, and available budget. Burleson anticipates that a number of high-priority restoration actions will remain after three years and encourages MPRPD to plan for this outcome. Below are suggestions for 2024 onward:

- Hire a land steward to visit the site on a quarterly basis. Have them:
    - Make repairs to compromised erosion control materials while in the field
    - Monitor for vandalism, trespass, and any new problems at Restoration Areas
    - Make recommendations for follow-up weed treatment
    - Pick up trash as feasible
    - Report to MPRPD on findings

- Address any major problems at RAs upon identification
- Spot treat weedy species in areas that were previously planted or sprayed
- Continue monitoring planting efficacy
- Use remote sensing to monitor changes in dune morphology over time to gauge effectiveness of erosion control measures
- Work with neighboring landowners to share lessons learned and collaborate on future restoration efforts
- Continue monitoring special status species
- Revisit this plan every two or three years to make adaptive management decisions and re-prioritize actions given success of restoration efforts

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APPENDIX A

2005 Dune Habitat Restoration Plan for Marina Dunes Preserve

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DUNE HABITAT RESTORATION PLAN
MARINA DUNES PRESERVE
MARINA, CALIFORNIA

Monterey Peninsula Regional Parks District
60 Garden Court, Suite 325
Monterey, CA 93940

December, 20, 2005

Prepapred by:
Joey Dorrell-Canepa
NATIVE SOLUTIONS
3479 San Juan Canyon Road
San Juan Bautista, CA. 95045

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Introduction

The following Dune Habitat Restoration Plan has been prepared for the Monterey Peninsula Regional Parks District (MPRPD) to guide the restoration and preservation of sand dune habitat at Marina Dunes Preserve in Marina, California. The 62 acre parcel is located adjacent to the Monterey Bay on Dunes Drive in Monterey County **(Fig. 1)**. Ten acres of the Marina Dunes Preserve has been owned and managed by the MPRPD as a public access corridor since 1990. Fifty-two acres of the Marina Dunes Preserve were acquired in 1998 from Granite Rock, a sand mining company. The Big Sur Land Trust provided interim ownership until conveyance to MPRPD. The entire parcel is now zoned as open space preserve. No development or construction is planned, only the fencing of walking paths and installation of educational signage.

The site is located within an environmentally sensitive area known as the Marina Dunes, which includes approximately 626 acres west of Highway One within the city limits of Marina. The Marina Dunes are part of the more extensive Monterey Dunes, which extend from Monterey harbor north to the Salinas River mouth in Monterey County, California. The different geologic histories of these dunes give rise to an unusual mosaic of vegetation found nowhere else along the Pacific Coast of North America (Pavlik and Zoger, 1990). The Monterey Dunes contain a unique blend of coastal species from northern and southern California and a large number of endemic species (native species of restricted distribution), resulting in areas of remarkable plant diversity.

At one time, sand was carried south from the Salinas River in longshore currents that followed the coastline, piling dunes to considerable heights along the southern half of Monterey Bay. After diversion of the Salinas River mouth north to Moss Landing Harbor**,** alluvial sand is no longer deposited along the shoreline, resulting in a substantial loss of sand for the Monterey Dunes (Thornton, 1994). Sand mining, development, and recreational use have also severely impacted the coastal dunes. The Monterey Dunes once contained over 50 native plant species, but are now much reduced by the above factors as well as the encroachment of non-native (exotic) species planted for erosion control, such as iceplant (*Carpobrotus edulis*) and Holland dune grass (*Ammophila arenaria*).

The Marina Dunes Preserve contains scattered pockets of pristine dune vegetation among disturbed dunes covered by non-native species. Iceplant (*Carpobrotus edulis*) has monopolized most of the site, reducing the cover of native species and habitat quality. Introduced cypress and eucalyptus trees dominate the southeastern portion of the parcel. The encroachment of iceplant, subsequent loss of native vegetation, and the orientation of the dunes have resulted in uncontrolled sand erosion and sand blowouts (moving sand sheets) at the Preserve. Fortunately, a broad diversity of coastal dune species is still present, and there is likely a substantial seed bank of native species remaining in the soil.

Surveys have documented several threatened or endangered (special status) species at the Marina Dunes Preserve and to the north in the Marina Dunes (Thomas Reid Associates, 1999, **Fig. 2)**. Recovery objectives for special status species include protecting existing populations from development, invasive weeds, predators, and

recreational degradation. Preservation and restoration of potential habitat is encouraged for maintenance and increase of these populations. Special status plant species at the Marina Dunes Preserve include sand gilia (*Gilia tenuiflora* ssp. *arenaria*), Monterey spineflower (*Chorizanthe pungens* var. *pungens*), and Yadon's wallflower (*Erysimum menziesii* ssp. *yadonii*). Special status animal species include the Smith's Blue butterfly (*Euphilotes enoptes smithi*) and the black legless lizard (*Anniella pulchra nigra*). The western snowy plover (*Charadrius alexandrinus nivosus*) is documented north of the Preserve in the dunes owned by CEMEX, formerly RMC Lonestar.

Successful restoration of the Marina Dunes Preserve will provide limited public access to an extraordinary showcase of coastal dune habitat. Restoration provides an opportunity to connect the southern corridor of sand dunes (Marina State Beach and Fort Ord Dunes State Park, over 1000 acres in various stages of restoration), with quality dune habitat all the way north to the Salinas River **(Fig. 2)**. The Marina Dunes Resort is the immediate neighbor to the south. Built on an abandoned sand mine in 1999, the Resort includes 6 acres of restored dune habitat surrounding 13 acres of development. To the north of the Marina Dunes Preserve is the largest undeveloped dune acreage along the Monterey Bay coastline. The CEMEX dunes contain a large, operating sand mine surrounded by semi-disturbed, vegetated dunes. The Martin Dunes include 120 acres of mostly pristine dune habitat and are privately owned in partnership with the Big Sur Land Trust. Connection with and preservation of these restored and mostly undeveloped dunes is extremely important for the sustainability of coastal dune habitat along the Monterey Bay.

Successful dune restoration at Marina Dunes Preserve requires weed eradication, the containment of non-native trees, sand stabilization, and the planting of appropriate native coastal species to augment the existing dune community. Native plant species stabilize the sand with deep, extensive root systems, as well as enhance habitat quality. Plant restoration supports native wildlife populations (especially special status species) by providing a variety of species-specific food and shelter.

The goal of this restoration plan is to describe existing biological resources at Marina Dunes Preserve and to define procedures and standards for restoration of the native coastal landscape. If the plan is implemented and monitored according to the plan, any adverse effects to existing native species or potential habitat can be avoided. The restoration program will significantly improve habitat value by increasing the quantity and diversity of native species, as well as expanding the corridor of restored dunes around the Monterey Bay. By designating the Marina Dunes Preserve as an open space preserve, the Monterey Peninsula Regional Parks District assures permanent protection of the restored area.

Biological Survey

The Marina Dunes Preserve is a 62 acre parcel that contains coastal strand and bluff, dune scrub, and maritime chaparral species **(Fig. 2)**. Non-native species include the invasive iceplant widely planted for erosion control, weedy annual grasses, and introduced forest species. According to Cooper (1967) and Pavlik (1990), the soils of the Monterey Dunes include recent dune soils (formed from "recent" alluvial depositions of the Salinas and Pajaro rivers) and Flandrian dunes formed and stabilized during the Wisconsin glaciation **(Fig. 2)**. Though much of the Marina Dunes Preserve is covered by iceplant, the sand appears to be high quality, judging from the diversity and quality of native dune vegetation growing in pockets throughout the parcel.

Sand movement at the Marina Dunes Preserve is considerable and appears to be caused by several factors: 1) the predominance of non-native iceplant, a shallow-rooted, heavy plant that smothers the native vegetation, changing the natural patterns of sand accretion and often sloughing off dune faces 2) historic sand mining and current recreational activity that prevents the native vegetation from establishing and stabilizing the sand 3) the perpendicular direction of the foredune and coastal bluffs to the ocean. Foredune orientation in the southern Monterey Bay is often parallel with the ocean and provides an important barrier to high winds and storm waves. The perpendicular orientation at the Preserve has resulted in considerable sand erosion along the coastal strand and sand movement to the inland side of the parcel, particularly in un-vegetated areas. The largest sand sheet measures 1,000,000 square feet and has existed since at least 1949 according to aerial photos. This sand sheet has buried the fencing along the eastern boundary of the Preserve and threatens to spill onto Dunes Drive, the frontage street of the parcel **(Fig. 1)**.

A survey at Marina Dunes Preserve on June 15, 2005 recorded 30 native species, providing approximately 25-40% vegetative cover over the whole parcel **(Table 1a)**. Coastal strand species include hardy, low-growing plants that have adapted to the exposed conditions next to the ocean, such as wind and salt spray. At Marina Dunes Preserve, coastal strand species are characterized by beach burr (*Ambrosia chamissonis*), sea rocket (*Cakile maritima*, non-native), beach morning glory (*Calystegia soldanella*) and beach primrose (*Camissonia cheiranthifolia*). Coastal bluff species at the Preserve include sparse, semi-woody shrubs perched along the edges of the ocean bluffs, such as coast buckwheat (*Eriogonum latifolium*) and lizardtail (*Eriophyllum staechadifolium*), as well as wind-tolerant, sand stabilizing species such as yellow sand verbena (*Abronia latifolia*) and sand dune bluegrass (*Poa douglasii*). Coastal scrub species are taller, shrubby species, well adapted to the dry, low nutrient soils of the mid-to-rear dunes. Dune scrub species on the site include beach sagewort (*Artemisia pcynocephala*), mock heather (*Ericameria ericoides*), and silver beach lupine (*Lupinus chamissonis*). Lower growing species such as bluff lettuce (*Dudleya caespitosa*), deerweed (*Lotus scoparius*), beach aster (*Lessingia filginifolia*) and beach poppy (*Eschscholzia californica var. maritima*) thrive between the shrubby species in this dune scrub ecotype. A pocket of maritime chaparral contains dense, tall shrubs tucked behind the rear dunes including coyote bush (*Baccharis pilularis*) and mock heather (*Ericameria ericoides*).

A large area of the Marina Dunes Preserve is disturbed due to the cover of 12 non-native species that have monopolized the available habitat and reduced native species diversity **(Table 1b)**. This non-native cover consists primarily of patches of iceplant (*Carpobrotus edulis*) that range from 25% to 100% cover, with the densest cover in the dune swales and on the coastal bluffs overlooking the ocean. An introduced forest covers ~8% of the parcel, and contains non-native gum trees (*Eucalyptus globulus*) and Monterey Cypress (*Cupressus macrocarpa*), that are native to Pebble Beach, but not the Marina Dunes. Ripgut grass (*Bromus diandrus*) and other weedy annuals occupy ~5% cover in the disturbed soils near the central gate and introduced forest **(Fig. 1)**.

There was evidence of a sizeable rodent population throughout the weedy areas of the parcel. In particular, the introduced forest area had numerous squirrel holes, gopher tailings and other signs of herbivore presence, such as rabbit and deer scat. A grey fox and an owl are often observed onsite, according to a frequent visitor.

From the northern gate, an access corridor leads to the beach (the original 10 acre corridor owned by MPRPD). This northern path is 10-15 feet wide and provides vehicular access for maintenance. It is spread with decomposed granite along its eastern half, for stability and potential handicapped access. An interpretive kiosk is displayed at the entrance from Dunes Drive and ocean safety signs are posted at the ocean end of the trail. Along the ocean bluff, concrete pads and coarse sands remain from the surf zone mining that occurred many years ago.

A central gate leads to a short road and staging area next to the introduced forest. This area appears to have been graded and is compacted with fill soils, judging from the surrounding vegetation **(Fig. 1)**. A high number of annual weeds occur here, adjacent to and within the introduced forest. From this central gate and road, numerous paths are scattered throughout the parcel. These unconsolidated pathways and the roads cover up to 10% of the Preserve.

According to the Marina Dunes Species Management Guidelines compiled by Thomas Reid Associates (1999), several special status species exist at the Marina Dunes Preserve and on nearby properties. Surveys of the parcel in 1987 and 2005 documented sand gilia (*Gilia tenuiflora* ssp. *arenaria,* state threatened, federally endangered), Monterey spineflower (*Chorizanthe pungens* var. *pungens*, federally threatened), and Yadon's wallflower (*Erysimum menziesii* ssp. *yadonii*, state and federally endangered, **Fig. 2)**. Animal surveys in 1987 and 1997 found the Smith's Blue butterfly (*Euphilotes enoptes smithii*, federally endangered, **Fig. 3)** and black legless lizard (*Anniella pulchra nigra*, state species of concern, **Fig. 4)** on the Preserve, and the western snowy plover (*Charadrius alexandrinus nivosus*, federally threatened) just to the north in the RMC Lonestar Dunes **(Fig. 5)**.

The small colony of **sand gilia** (*Gilia tenuiflora* ssp. *arenaria*) occurs next to the introduced forest on the ocean side and included ~150 individuals in this prolific rain year (late survey may have underestimated numbers, **Fig. 2)**. The individuals ranged from 3 to 10 inches in diameter. A previous survey in 1993 counted 350 sand gilia onsite (Dorrell-Canepa, 1994). Sand gilia prefers open sands in mid-to-rear dune areas, protected from the exposed winds and salt spray of the foredunes. Associated native vegetative cover rarely exceeds 50%. After iceplant eradication, there will be many rear

dune areas suitable for expansion of the sand gilia colony at the Marina Dunes Preserve.

Monterey spineflower (*Chorizanthe pungens* var. *pungens*) was found scattered throughout the mid-to-rear dunes of the parcel. The species is relatively abundant onsite, with ample suitable habitat available for expansion **(Fig. 2)**.

Yadon's wallflower *(Erysimum menziesii* ssp. *yadonii*) was planted in the foredunes of the Marina Dunes Preserve from site-specific collection at RMC Lonestar Dunes immediately north of the parcel (300 seedlings, **Fig. 2)**. This endangered species is known only from the Marina Dunes. It was likely more abundant along the coastal bluffs of Marina at one time, but the colonies "migrate" considerably due to storm and bluff erosion (Thomas Reid Associates, 1999). Yadon's wallflower thrives in open areas free of other plant competition and tolerates moderate sand burial. Suitable habitat exists on the parcel for expansion of the population; however establishment is often difficult due to the windy, unpredictable nature of the foredunes.

The **Smith's Blue Butterfly** (*Euphilotes enoptes smithi*) was documented at Marina Dunes Preserve in 1987 and in the RMC Lonestar and Martin Dunes in 1997 (no surveys were conducted onsite that year, Thomas Reid Associates, 1999, **Fig. 3)**. The butterfly has also been documented to the south at Marina State Beach (Arnold, 1986). The Smith's Blue Butterfly only associates with coast buckwheat (*Eriogonum latifolium*) and dune buckwheat (*Eriogonum parvifolium*), the two host plants. The butterfly spends its entire life cycle associated with buckwheat, utilizing the nectar as a food source, laying eggs, and overwintering beneath the plant. A decrease in dune buckwheat (E. parvifolium) at the Marina Dunes Preserve has led to a documented shift in Smith's Blue colonization patterns to coast buckwheat (*E. latifolium*), now the dominant species onsite. Smith's Blue butterfly is thought to have a "stepping-stone" dispersal pattern, which allows gene flow between adjacent colonies throughout the population's distribution. Any interruption to suitable habitat areas wider than 50 feet may act as a barrier to butterfly dispersal (Thomas Reid Associates, 1999). Sheltered rear dune areas tend to support more butterflies than the more exposed foredunes and mid-dunes.

The Marina Dunes Preserve contains abundant habitat suitable for the expansion of coast and dune buckwheat populations with a likely increase in the Smith's Blue Butterfly population. Only the introduced forest area on the site provides a substantial barrier to butterfly flight. An increase in buckwheat cover is especially important at the Preserve to link the substantial butterfly populations of the northern Marina Dunes (Lonestar and Martin Dunes) to butterfly populations in the southern Marina Dunes, including the restored dune habitat at Marina Dunes Resort and Marina State Beach.

The **black legless lizard** (*Anniella pulchra nigra*) was originally proposed for federal listing in 1995, but was withdrawn in 1998 because its range was considerably more extensive that originally thought. Over much of its range, the black legless lizard is found in the habitats occupied by the Smith's Blue butterfly. Thus, the lizard benefits from the same habitat restoration and preservation efforts that support the Smith's Blue Butterfly (removal of exotic vegetation, restoration of native plant communities).

Black legless lizards were found at the Marina Dunes Preserve in 1987 in areas primarily covered with native vegetation (Thomas Reid Associates, 1999, **Fig. 4)**. The lizards are generally observed in sandy washes or native vegetated dunes on all slope aspects and habitat types, except bare sand. The lizards prefer large woody shrubs such as mock heather (*Ericameria ericoides*) and silver beach lupine (*Lupinus chamissonis*), which provide a shady cover and cool, deep sand that is easily penetrable. They forage for insects and spiders in leaf litter in the daytime and come to the surface around dusk.

Western snowy plovers (*Charadrius alexandrinus nivosus*) are known to nest at Marina State Beach and from the RMC Lonestar Dunes (CEMEX) north to Elkhorn Slough (U.S. Fish and Wildlife Service, 1993, **Fig. 5)**. The species has not been reported to nest at the Marina Dunes Preserve. Preferred habitats for nesting in the Marina Dunes include dune backed beaches and un-vegetated beach strands. Nest sites typically occur in flat, open areas with sandy substrate, with vegetation and driftwood sparse or absent. Most plovers are site-faithful, returning to the same breeding site in subsequent breeding seasons. Their nesting habitat is unstable due to high winds, storms, wave action and plant colonization. Poor reproductive success, resulting from human disturbance, urban development, predation, and inclement weather, combined with the loss of nesting habitat to the introduced European beachgrass (*Ammophila arenaria*), has led to a decline in active nesting colonies, as well as an overall decline in the population of the western snowy plover along the Pacific Coast of the United States. The relatively successful nesting population of snowy plovers in the northern Marina Dunes appears to be related to the low level of human disturbance away from developed beach access areas (Thomas Reid Associates, 1999). Restoration of the foredune at the Marina Dunes Preserve should be planned around the potential presence of roosting or nesting plovers, allowing un-vegetated areas to remain in between planted areas.

Restoration Plan

The primary goal of the restoration plan is to restore 62 acres with a diversified palette of native dune strand and coastal scrub species that are surviving, growing and reproducing within five years of installation. Non-native species shall be eradicated and controlled throughout the restoration area. Drifting sand shall be controlled with sand stabilization techniques and re-vegetation efforts. Revegetation of the native species shall include the collection of site-specific seed, broadcast seeding, hydroseeding, and the outplanting of propagated seedlings. Special status plant species and their habitat shall be enhanced through native re-vegetation efforts, and by seed collection and increase from the existing populations on site. Structural improvements shall include fencing to protect restored areas and delineate pathways. Interpretive signage shall educate about the native dune habitat and inform passersby that restored areas are off limits. Once restored, maintenance and monitoring to specific performance criteria shall ensure a continued progression towards a diverse and sustainable dune community. Figures and tables list existing species and biological features, proposed species for the restoration effort and detail specific areas for recommended procedures. A schedule and estimated budget allow efficient planning of the restoration effort.

The success of dune restoration depends on proper timing of sand stabilization, weed control, seeding, and planting. Working outside the “restoration window” for native species is a waste of time, effort, and materials. Native plants in the Monterey Dunes are specifically adapted to a rainy winter and dry summer/ fall. Dune species usually germinate after the first rains of winter, increasing in size and flowering as spring progresses. Therefore, broadcasted seed must be in place when rains start, and planting from containers must be done early in the rainy season. When rainfall ceases in May-June, the plants slow their growth, usually producing seed by the end of summer or fall. Throughout the dry summer and fall, the perennial dune species may appear brown and desiccated, but their deep roots keep them alive. During this dormant summer period, native species survive by absorbing moisture and nutrients from the fog that blankets the coastline. Seed dispersed by the native species awaits the arrival of winter rainfall in November or December to begin the cycle of germination and growth once again.

Rapid plant establishment in disturbed sand dunes is important for sand stabilization as well as aesthetic reasons. Every site varies considerably with respect to the microhabitats available for plant establishment. Important factors that affect establishment include soil moisture and quality, the presence of existing vegetation, wind patterns, and herbivore presence. After elimination of exotic species, a variety of stabilization and re-vegetation techniques may be chosen for the treatment area, including broadcast seeding, hydroseeding (native seed sprayed in a water-based slurry with wood fiber mulch, tackifier and fertilizer), straw planting (vertical bunches of straw, with or without broadcasted seed), and straw crimping by machine over broadcasted seed. Transplantation of container seedlings (outplanting) is an important final step for increasing diversity in sensitive or problem areas, and for providing larger plants with greater reproductive output. The proposed plant list includes native species found in

undisturbed areas on the site, and from un-restored areas of the RMC Lonestar Dunes (CEMEX) and Marina State Beach, adjacent sites with high natural diversity **(Table 2)**.

Restoration at the Marina Dunes Preserve should be staged over three to five years, with 15-20 acres treated each year. Experimental stabilization and re-vegetation treatments in the first two years shall guide the complete treatment of the un-vegetated sand blowouts and exposed foredunes in the third year. Multi-year staging increases establishment success by allowing adaptive management of the site, which includes a continuous assessment of the treated areas and modification of restoration techniques as needed. Weed control is most efficient if followed by immediate re-vegetation efforts (broadcast seeding, outplanting) the following rainy season. Twenty acres is a reasonable acreage for implementing restoration efforts when winter rainfall rarely lasts more than three months, providing a narrow window for plant germination and establishment. Restoration occurring over several years optimizes plant establishment and seed collection efforts. Each year, the winter rainfall, temperature and wind patterns vary considerably. Different native species establish and thrive under the different weather conditions. Likewise, seed collection spread over several years takes advantage of cyclical differences in seed production and viability. Some native species actually produce more seed in dry years.

1. Restoration Goals and Objectives

- Eradicate and control non-native vegetation and gophers/ ground squirrels as needed.
- Remove construction debris.
- Re-contour sand blowout and augment degraded areas with the excavated sand.
- Stabilize sand to prevent wind erosion.
- Install fencing to delineate walking trails and protect restored areas.
- Revegetate with site specific, native species that are representative of the Marina Dunes coastal community.
- Enhance potential and existing habitat for endangered species.
- Implement a monitoring program based on qualitative and quantitative standards.
- Establish a long term management program for maintaining and preserving the restoration areas.
- Enhance visitor appreciation through interpretive signage.

2. Restoration Procedures

Restoration activities shall be implemented according to this plan by a qualified restoration biologist and contractor, who shall be onsite for all activities. The timing of implementation shall adhere to the restoration schedule for optimal plant establishment and erosion control (Table 4), but adaptive management shall be practiced. For

instance, if early rains occur and the extended forecast is favorable, then revegetation methods can begin early. If broadcasted seed or hydroseeding efforts fail to germinate, then the outplanting of container stock shall be adjusted for optimal plant coverage. Analysis of unsuccessful areas shall guide changes in plant species, stabilization technique(s), or herbivore and weed control.

3. Multi-Year Restoration Schedule

Year One: 20 acres (southern section)

- Eradicate iceplant on southern third of property, in deep swales, Ammophila (foredune)
- Clean up forest area, remove dead trees, control saplings, gophers, squirrels
- Excavate buffer area for sand sheet, add sand to central gate area
- Re-fence eastern boundary, fence central path, repair northern path as needed
- Begin pathway reclamation, monitor use patterns
- Seed collect, propagate 15000 seedlings
- Broadcast seed and outplant southern third of property
- Experimentally treat origin of sand sheet (western edges) & foredune areas:
- (Straw planting, drift fencing, broadcasting, straw crimping over seed?)
- Add endangered spp. to outskirts of sand gilia colony, Yadon's colony, spineflower
- Spray annuals

Year Two: 20 acres (middle section)

- Eradicate iceplant, spot treat previously sprayed, monitor Ammophila
- Control forest escapes, gophers, squirrels
- RE-excavate sand sheet as needed, add to central area
- Fence off pathways, revegetate
- Seed collect, propagate 15000 seedlings
- Broadcast and outplant middle third of property
- Continue sand stabilization experiments, moving inland on sand sheet, foredune
- Add gilia, Yadon's, spineflower to suitable areas restored in Year One
- Spray annuals

Year Three: 20 acres (northern section)

- Eradicate rest of iceplant, spot treat previously sprayed, monitor Ammophila
- Control forest escapes, gophers, squirrels
- Continue pathway reclamation
- Seed collect, propagate 15000 seedlings
- Broadcast and outplant northern third of property
- Continue sand stabilization, moving back on sand sheet, foredune
- Treat large area of sand sheet with drift fencing, straw crimping over seed, hydroseeding,
- Add gilia, Yadon's, spineflower
- Spray annuals
- Add interpretive signs

4. Weed Eradication and Control:

- To eradicate exotic (non-native) species before restoration efforts begin.
- To control weeds at less than 10% cover in subsequent years.

Invasive, exotic species monopolize available dune habitat, reduce diversity, and prevent germination of the desired native species. *Carpobrotus edulis* (iceplant) and other exotic grasses are the most significant invasive weeds on the parcel **(Table 1b)**. Their control is essential for long term restoration success. Because these non-native species exist on adjacent properties, it is difficult to achieve complete eradication. However, a well-timed weed control program can keep the non-native species to a minimum.

The project area shall be sprayed before restoration begins with Roundup herbicide at 2% concentration, leaving a buffer zone around any native plants, where the weeds should be hand-pulled. The herbicide shall be sprayed by a certified pesticide applicator on non-windy days to prevent chemical drift. Once restoration efforts have commenced, herbicide application must be done by an applicator experienced at identifying native and non-native species in juvenile and adult stage. If hand-pulling becomes necessary, it shall be done in the spring before the weed seed ripens. Proper disposal of all herbicide containers is required.

Depending on thickness, iceplant spraying shall occur at least 6-12 months before re-vegetation efforts begin, so that the iceplant decomposes enough for efficient container planting. In areas with very thick iceplant, re-vegetation may need to be delayed until the second year of treatment. However, planting in the decomposed iceplant mats or seeding between the mats shall be done as soon as possible to prevent annual grasses from colonizing the iceplant mulch. This mulch becomes a magnet for invading weeds being richer in nutrients than the surrounding sands.

In areas with a substantial cover of native species, iceplant should be sprayed in late fall when the natives are essentially dormant and germinating native seedlings are at a minimum. In weedy, disturbed areas, iceplant should be sprayed in early to late spring so that the annual weeds and grasses are also eliminated before their seed is dispersed. Before re-vegetation with native species in these weedy areas with degraded soils, the bank of undesirable seed needs to be eliminated over several years of germination and eradication. To prevent re-colonization of the iceplant, it is essential to spray any re-growth of the mats and to pull small seedlings.

For budget reasons, the planted eucalyptus and cypress trees on the parcel need not be removed until they die of natural causes, although the shaded grove prevents complete restoration of the rear dune habitat. However, young saplings and dead trees shall be sprayed or removed to prevent further spread of the introduced stand. A lone acacia in the rear dunes near the forested area shall be removed.

A 400 sq. ft. stand of European beachgrass (*Ammophila arenaria*) on the parcel shall be sprayed and carefully monitored for reinvasion **(Fig. 1)**. This highly invasive dune grass forms a dense plant cover and has monopolized many acres of valuable coastal dune habitat to the north, reducing native species diversity while changing beach topography (Weidemann and Pickart, 1996). European beach grass requires repeat spraying in the spring when shoot growth is most active. Herbicide applications of 4% or 10% Glyphosate (Roundup) with 0.5 % added surfactant have been shown to be effective at reducing cover by 90% or more (Bossard et al, 2000).

In severely degraded areas, gopher and ground squirrel eradication with phos-toxin gas (Weevil-cide) or non-secondary rodent bait is recommended prior to planting (Fig. 1). This gas may inadvertently harm black legless lizards and other beneficial soil dwellers as it permeates the rodent burrows and tunnels. However, lizard presence is probably low to non-existent in degraded areas that lack the loose sands and established native vegetation that lizards prefer (Thomas Reid Associates, 1999). Gophers proliferate in areas with depleted soil, where weed cover also prevents the establishment of native plant species. Where possible, augmentation with quality sand from another part of the site shall be preferred to chemical controls for rodents.

5. Removal of Construction Debris:

- To remove any sand mining or construction debris for public safety.

Large, rusting debris presents a liability hazard for public use of the Marina Dunes Preserve **(Fig. 1)**. Before restoration begins, the debris shall be removed to a certified landfill. To access the debris along the ocean bluff, appropriate equipment may need to drive by permission onto Marina State Beach from the Reservation Road parking lot. The remaining debris is in the forested area, accessible from Dunes Drive. Coordination with California Department of Parks and Recreation and the Marina Dunes Resort could result in a joint effort to rid the ocean bluffs of other unsightly and dangerous debris left from sand mining operations.

6. Sand Recontouring and Augmentation:

- To prevent sand burial of city property along Dunes Drive.
- To increase plant establishment by adding clean sand to degraded areas.

Un-vegetated sand along the eastern boundary of the Marina Dunes Preserve shall be removed to avoid encroachment onto the City of Marina's right of way along Dunes Drive. The sand sheet in this area has accumulated to almost 25 feet and buries the boundary fencing. Machinery shall create a buffer zone on MPRPD property to catch moving sands until the sand sheet is (hopefully) stabilized after several years of treatment. It is unlikely that any black legless lizards will be disturbed by sand excavation, because unconsolidated sand sheets do not support the native shrubby vegetation required for shelter and support of the lizard's food sources (Thomas Reid Associates, 1999).

The excavated sand shall be used to increase planting success on degraded areas of the site. Under supervision of the restoration biologist, sand shall be added inside the introduced forest and along the compacted road leading from the central gate **(Fig. 1)**. Before augmentation, the central road should be narrowed to 10 or 15 feet depending on desired use (vehicular or pedestrian). The sand shall be added to a depth of one to three feet along both sides of the roadway, preferably with some prior loosening of the compacted soils. The sand shall be spread into mounds by rake or mechanical means, mimicking natural dune topography, but allowing the wind to do the final sculpting. Vehicles carrying the sand shall travel along the designated roadway wherever possible to prevent unnecessary compaction of the restored areas.

7. Sand Stabilization:

- To hold bare sand in place for increased establishment of native vegetation;
- To provide wind protection for transplanted seedlings in barren areas;
- To stabilize large sand blowouts, preventing erosion and sand drift.

Most native dune species have deep roots that increase survival and stabilize the sand, preventing erosion. These roots provide a physical structure, and attract a "web" of fungal associations that serve to increase nutrient uptake. In un-vegetated areas, or after the addition of fresh sand, stabilization techniques hold the sand in place and protect young plants from wind while the root system develops. Various stabilization techniques include the installation of straw bunches (straw planting), drift fencing, mechanical straw crimping, and hydroseeding. Sand stabilization should occur within 48 hours of recontouring or sand augmentation. Stabilization should not be necessary in areas interspersed with existing native vegetation or in dead iceplant.

Small areas of bare sand in exposed areas or surrounded by only minimal native vegetation may require straw planting for stabilization **(Fig. 6)**. Hand-sized bunches of sterile straw are "planted" on 18-24 inch centers to a depth of three inches, leaving 6-10 inches protruding vertically from the sand. Seedlings planted on the leeward side of the upright

straw bunches are protected from wind, and moisture retention is improved next to the straw. The open sand between bunches allows effective native seed dispersal and germination. Straw bunches usually persist for several years until they decompose or are buried by sand. Approximately 2000 pounds of straw and 320 man hours are needed per acre of bare sand (Ferreira and Gray, 1986). Native seed may be broadcasted and raked in or naturally worked into the sand as crews install the straw bunches. Any straw planting in the foredunes at the Preserve shall occur in pods to allow open areas for the potential presence of roosting or nesting snowy plovers (*Charadrius alexandrinus nivosus*).

Fast moving sand needs a combination of techniques to provide barriers to wind movement, such as **drift fencing** and/or straw planting, with secondary treatments to increase plant cover such as broadcast seeding, mechanical straw crimping and/or hydroseeding **(Fig. 6)**. Drift fencing can provide an effective physical barrier to moving sands, giving vegetation a chance to establish in the unconsolidated sands. Lath and wire "snow-fencing" is typically erected in parallel rows of 100-200 feet, approximately twenty feet apart, perpendicular to the prevailing wind. The sections of fencing should be routinely lifted and maintained to prevent broken slats and loose wire. Drift fencing is not appropriate in foredune areas that are potential habitat for the western snowy plover, as the fencing may provide a significant barrier to roosting and nesting efforts.

For large un-vegetated areas with gentle slopes, **mechanical straw crimping** is an effective method of sand stabilization **(Fig. 6)**. Sterile straw is blown by machine onto the surface of the sand after broadcasting native seed at ~15#/ acre, and the sand surface is rolled with a tractor-drawn straw crimper, which punches the straw into the sand over top of broadcasted native seed. Approximately 4000# of straw is used per acre. The straw blows around and may provide more sand coverage than is optimal for the germination of native dune species. However, straw crimping creates a roughened surface with ample crevices for seed protection and germination.

Hydroseeding at the proper time of year (November-December) is an economical treatment for stabilization and an even dispersal of a variety of native species **(Fig. 6)**. Hydroseeding uses a custom blend of native seed with mulch, tackifier, and small doses of fertilizer, mixed into slurry that is extruded onto the sand. The slurry usually holds the seed in place on the sand, and the seeds germinate after sufficient rainfall (or irrigation). Hydroseeding is an effective option for steep un-vegetated areas which are difficult to treat with other methods, but is not as effective over unconsolidated sand sheets. See the Hydroseeding section for technical specifications.

8. Protective Fencing:

- **To protect restored areas from human and pet impacts and to delineate public access corridors to the beach.**

Guideline fencing shall be installed or upgraded along the designated pathways, separating the fragile dune habitat and restored areas from pedestrian use **(Fig. 7)**. Boundary fencing along Dunes Drive should be more substantial than guideline fencing as a visual deterrent to trespass. The southern boundary is currently unfenced and

blends into restored dune habitat at the Marina Dunes Resort. If pedestrian use increases at this border, then guideline fencing may need to be installed to protect the habitat. The central and northern gates should be updated and signage coordinated to unify the two entrances.

Symbolic guideline fencing strung with black cable is recommended for a non-obtrusive look along the pathways. Anchor rods (eye rods) can be placed every 10-12 feet and strung with cable connected with furrels. Nuts screwed on the bottom of the rods rust into the sand and make the rods difficult to remove. Guideline fencing requires proper construction and routine maintenance to keep the anchor rods straight and the cable evenly stretched with only a slight curve between anchor rods.

To prevent damage to germinating seedlings and fragile areas, fencing should be installed before sand stabilization and re-vegetation efforts begin. **Fig. 6** shows the main pathways to the beach. Other connecting pathways may remain, depending on user trends, if the majority of criss-crossing pathways are re-vegetated. The reclamation of old pathways may require temporary slat fencing with signage blocking the path until pedestrians learn to use the designated pathways. Signage stating "Restoration in progress, please do not enter" is informational, while requesting compliance. Routine monitoring of the fenced areas will indicate problem areas, such as shortcuts through sensitive habitat or areas with high recreational use. Fencing may need to be redesigned to accommodate some of these problem areas, or the density of native vegetation increased to discourage trespass.

At this time, the Marina Dunes Preserve has relatively few visitors per acre. Pedestrians use the northern corridor, but often walk along the ridgetops for the freedom of being "on top of the world". While this ridge walking can be damaging, it may be acceptable if use level remains low. Pedestrian use of the ridgetops should be monitored and perhaps used to plan a ridgeline pathway with minimal impacts. At this site, it is likely that iceplant encroachment has done more to reduce habitat quality and increase sand erosion than any amount of pedestrian impact.

9. Seed Collection:

- **To collect site-specific seed for seeding and propagation efforts.**

To preserve genetic integrity, all native species used shall be collected from the nearest source, or no more than three miles from the site. Adequate quantities of seed for increase of the special status species is available onsite (sand gilia, Monterey spineflower, Yadon's wallflower). Plant species adapt to changes in their immediate environment, leading to evolutionary changes that increase survival for the species. This genetic variation is often very specific to microhabitat and locale. The plants grown from nearby, site-specific seed will contain the adaptive traits needed to ensure long term survival at the site.

The proposed plant list includes native species found in undisturbed areas on the parcel, and from pristine areas with high natural diversity at Marina State Beach and CEMEX dunes. Seed shall be collected under the supervision of a restoration biologist by permission from the California Department of Parks and Recreation and CEMEX.

Maximum genetic diversity shall be assured by collecting seed from un-restored sections of the nearby dune areas, and by gathering from as many different plants of the same species as possible. No more than 10% of the seed from any one plant shall be collected. From special status species onsite, less than 5% of the seed shall be collected to prevent any negative impacts to the endangered populations. Seed shall be collected from May through October, stored in paper bags, and used within several months of collection for maximum viability. Therefore, seed must be collected each year for re-vegetation efforts in the fall-winter season. Seed collection shall occur over at least three years for optimal species diversity and establishment. Native dune species often have fluctuating seed yields and viability, related to winter rainfall and temperatures.

Table 2 contains a list of suggested species and quantities for seed collection. The amount of seed and plant numbers may be modified by the project biologist if permit issuance or site preparation prevents planting in early winter (December through January). **Fig. 2** shows the general location for the different vegetation ecotypes found on the site. Table 3 lists which native species are appropriate for each ecotype. Low-growing, coastal strand species that are resistant to wind, such as *Ambrosia chamissonis* (beach burr) and *Abronia latifolia* (yellow sand verbena), and *Poa douglasii* (dune blue grass) will be used in the most exposed areas on the foredunes and coastal bluffs. Taller coastal scrub species, such as *Lupinus chamissonis* (silver beach lupine), *Eriophyllum staechadifolium* (lizardtail), and coast buckwheat (*Eriogonum latifolium*), will be used in the more protected dune swales and ridges of the mid to rear dunes to hold the sand in place and improve habitat values.

10. Broadcast Seeding:

- To broadcast a mixture of site-specific, native dune seed over unvegetated areas to enhance species diversity and cover and ultimately stabilize the sand.

The most economical method to increase native species cover is broadcast seeding and raking of site-specific seed, because machinery is unnecessary. Broadcasting seed can broaden the diversity of species compared to natural wind dispersal, and the improved seed to soil contact after raking increases germination. The method works best in relatively small areas (<1 acre) where the sand is relatively stable with some existing native vegetation. It is effective for the reclamation of pathways and on foredunes before or after straw planting for stabilization. Seeding over iceplant mats is not effective unless decomposition is sufficient to allow good seed to soil contact (one to three years). Germination from broadcast seeding increases with consistent rainfall/ irrigation but it is not required because the seed will often remain dormant until there is sufficient moisture, sometimes even germinating the following year (i.e. deerweed, *Lotus scoparius*).

Broadcast seeding shall occur in October-November, before winter rainfall begins, and after all late ripening seed has been collected. Seed shall be spread by hand onto the sand or fully decomposed iceplant litter and raked in lightly. Two seed mixes shall be

created, corresponding to the two general ecotypes (coastal strand or scrub) and their appropriate location in the fore or mid-to-rear dunes. **Table 2** lists suggestions for native species to be used for broadcasting and seed quantities. Several foredune species, such as beach burr (*Ambrosia chamissonis*) and the sand verbenas (*Abronia* spp.), require burial of at least one inch for germination. Therefore, they should be broadcasted and raked in with no further treatment (with the exception of straw planting) to avoid wasting the seed, which is difficult to collect in quantity.

11. Hydroseeding:

- To disperse a mixture of site-specific native dune seed in a slurry over un-vegetated areas to stabilize the sand and enhance native species diversity and cover.

Hydroseeding is efficient and economical for large barren areas, because it uniformly distributes a diverse mixture of seed. Soil moisture is conserved, promoting seed germination, and the slurry prevents (slight to moderate) sand movement during plant establishment. For most effective treatment of sand blowout areas, hydroseeding should be combined with drift fencing and possibly corridors of straw planting. Hydroseeding over dead iceplant is ineffective, as the slurry containing the native seed must have good contact with the sand surface for germination to occur. Hydroseeding depends on consistent rainfall or irrigation for optimal success.

Hydroseeding shall be done in November-December at the beginning of the rainy season for optimal seed germination. Any large scale sand augmentation shall be immediately followed with hydroseeding, so that the loose sand is stabilized by the extruded slurry.

The following hydroseeding specifications are recommended for sand dunes. Wood fiber mulch shall be applied at a rate of 2000 pounds per acre. Tackifier (M-binder or equivalent) shall be applied at a rate of 80 pounds per acre. Fertilizer shall be applied at a reduced rate (compared to other habitats) of 100 pounds per acre using Nutricote or Osmacote (14-14-14) controlled release fertilizer, Type 180. A rear dune/ coastal scrub seed mix shall be included in the slurry at 15#/ acre. Any dune areas with diverse native vegetation, especially special status species, shall be completely avoided with the hydroseeding slurry.

12. Propagation:

- To grow site-specific seedlings in containers and maintain them in optimal condition for outplanting in early winter (December-January).

Table 2 contains a list of suggested native species and plant numbers. Container plants shall be grown by a local nursery that specializes in growing native sand dune plants, and has a proven track record of satisfied customers. Propagation of the seed shall be done in sterile media designed for germination (i.e. McCalif's Germination Mix #3) in "stubby" cells manufactured by Stuewe and Sons, Inc. (Corvallis, Oregon). The germination mix shall be used in a 3:1 ratio with sand from nearby vegetated areas to

provide site-specific mycorrhizae that will facilitate plant establishment. Approximately two ounces of pelleted fertilizer shall be added to the soil mix per tray of 98 cells (Osmacote or similar brand, 90 day timed release, NPK 14-14-14).

The native, site-specific seed shall be made available to the nursery in time to allow propagation to occur in late August or early September. Propagation should take approximately three months for seedling growth, preferably with a hardening-off period before outplanting. At least some of the seedlings should be ready for outplanting (with a well-developed root system) by mid-December to take advantage of early rainfall should it occur. Consistent watering, thinning to one seedling per cell, and the prevention of herbivory are all essential for the survival and health of the dune seedlings.

13. Outplanting:

- To plant specified numbers of container seedlings in the appropriate locations, augmenting broadcast seeding/ hydroseeding efforts;
- To optimize seedling establishment by timing installation with winter rains;
- To improve diversity of the existing native community and encourage rapid plant establishment in barren areas.

Transplanting or outplanting seedlings from containers provides fast growth for improved sand stability and maximum reproductive efficiency. Plant establishment is usually successful from container stock, particularly in areas with existing vegetation or when combined with straw planting for sand stabilization. Container plants grow larger and reproduce more quickly than plants that germinate from seed after the first rains of winter. Container seedlings can be planted into dead iceplant where broadcasted seed or hydroseeding would be ineffective. However, compared to plants that germinate from seed onsite, container plants are often more affected by inconsistent rainfall, high winds, and grazing by herbivores. Native plants from seed germinate after finding a suitable microniche and sufficient water, thus they often have an advantage over seedlings planted at a specified density with no possible knowledge of the microhabitat.

The suggested plant numbers will supplement broadcast seeding and/or hydro-seeding efforts with the outplanting of approximately 1000 seedlings per acre. Survival of the seedlings depends on careful planting by trained staff. The plant shall be firmly tamped into the sand and the root mass completely buried with a shallow well 2-3 inches deep created around each seedling to conserve rainwater. Plant spacing and location vary according to species and existing vegetation, and shall be under the supervision of the restoration biologist, using **Fig. 2** and **Table 3** as a guide. The biologist may need to adjust plant numbers according to seed viability and germination success.

Planting of the seedlings shall occur after the first storms of the winter season have thoroughly soaked the sand. Around the Monterey Bay, planting conditions are usually optimal by late December or early January when at least 2 inches of rain has fallen and more rainfall is expected within the week. Planting should not occur on unseasonably hot or windy days, as young seedlings may suffer on the exposed sand dunes. Planting

should occur in stages, so that herbivory and other unforeseen conditions can be controlled before all the plant material is compromised.

Thick iceplant must be given time to decompose, or planting efforts will be inefficient and tiresome. The decomposing litter of the iceplant will hold the sand in place and act as a protective windbreak for the out-planted seedlings. Seedlings can be planted directly into 12 inch clearings in the iceplant or along the edges of the mats, allowing the iceplant to act as mulch, preventing weed growth while it decomposes. In more exposed areas, dead iceplant can be formed into a circle around each young seedling, providing valuable wind protection.

In areas with straw planting for stabilization the seedlings shall be planted in the lee of the straw bunches where there is maximal wind protection and moisture conservation. In areas with no stabilization treatment, new seedlings shall be installed using the existing vegetation as a buffer wherever possible.

14. Special Status Species:

- To create and enhance appropriate habitat for six special status species: sand gilia (*Gilia tenuiflora* ssp. *arenaria*), Monterey spineflower (*Chorizanthe pungens* var. *pungens*), Yadon's wallflower (*Erysimum menziesii* ssp. *yadonii*);
- To increase each special status plant species to a "sustainable" level of 1000 individuals each;
- To plant Eriogonum parvifolium and latifolium in support of Smith's blue butterfly;
- To restore native coastal scrub species and eliminate non-native species to support black legless lizard expansion;
- To restore foredunes in a manner that creates suitable snowy plover habitat.

Sand gilia, Monterey spineflower, and Yadon's wallflower are all found at the Marina Dunes Preserve in limited quantities. Increase of these special status species will be naturally encouraged by restoring the parcel to native species and eliminating the iceplant, leaving the patches of open sand that naturally occur between existing dune vegetation. Both sand gilia and Monterey spineflower are usually found in open sands associated with sparse, low-growing native vegetation in the mid-to-rear dunes. Yadon's wallflower occurs in the open sands of the exposed foredune, where growing conditions are tough and there is little plant competition.

Sand gilia: There is ample opportunity for sand gilia enhancement after habitat improvement in the mid-to-rear dunes of the Marina Dunes Preserve. The presence of a designated pathway bordering the existing gilia population provides a unique opportunity for interpretive signage showing the sand gilia in its natural habitat **(Fig. 6)**.

This annual, self-pollinating species disperses ample seed when growing in quality sands, free of herbivory and protected from winds. Onsite seed collection shall occur in late April-May, with weekly monitoring for seed readiness, as the seed capsules dehisce rapidly and completely. Seed shall be collected from as many individuals as possible, with no more than 5% of the seed harvested from any one plant. Nursery propagation of

the seed is recommended since broadcasting is difficult due to the tiny, sand grain-like seed. Seedlings shall be grown in cells using the same techniques and timing described in the Propagation section. Outplanting shall occur in open sand between existing low-growing vegetation occupying less than 25-50% cover. Swales, flat areas, and low dunes are preferred receiver sites over steep or south-facing slopes. Several plantings should be sequenced over the winter season with frequent survival monitoring to modify any unforeseen conditions, such as herbivory or erosion. Individuals should be planted in "colonies" of 25-50 individuals with 1 foot spacing. First year monitoring of survival is greatly facilitated by planting in a series of lines, but these lines can wind between and slightly under existing vegetation for increased protection.

Monterey spineflower: Broadcast seeding of the annual Monterey spineflower is a effective and economical way to increase population numbers. Seed is easily collected July through August, when plants are thoroughly desiccated, and the accompanying plant debris need not be separated from the seed. Because of its clumping spines, spineflower is most effectively broadcasted after mixing with other dune seed before winter rains begin in October-November. Seed shall be dispersed and lightly raked in between existing vegetation of the mid-to-rear dunes. Monterey spineflower efficiently colonizes unwanted pathways, sparse or un-vegetated areas, and disturbed soils. Herbivory is rarely a problem for this species. Broadcast seeding followed by even moderate rainfall will result in hundreds of new seedlings from the highly viable seed, ensuring natural regeneration for years to come. Monterey spineflower grows rapidly in nursery containers, but top growth is horizontal, so seedlings must be used promptly or become difficult to separate.

Yadon's wallflower: This species was grown from seed from the nearest (and largest) source, RMC Lonestar Dunes (Cemex) in 1999-2000 (~300 seedlings) and has continued to increase in the exposed foredunes of the site. Seed of this often perennial species shall be collected July through August, from as many individuals as possible, with no more than 5% of the seed harvested from any one plant. If ample seed is collected, some can be broadcasted in foredune areas un-colonized by the species. A portion or all of the seed (if limited) should be propagated in cells for outplanting in early winter. Straw planting in exposed foredune areas increases the survival and establishment of the wallflower seedlings. However, any straw planting or outplanting in the Marina foredunes shall be done in pods to facilitate co-existence with the western snowy plover, which prefers un-vegetated beaches for nesting and winter roosting. Wallflower seedlings can also be planted behind other species such as sea rocket (Cakile maritime) for protection from the unpredictable and strong winds of the foredune.

The establishment of the special status plant species shall be monitored annually by counting or estimating (if numbers are high) all reproductive individuals on the parcel: sand gilia (April-May), spineflower (May-June), Yadon's wallflower (June-August). The desired five year goal of at least 1000 individuals per species shall be indexed to surrounding natural populations, as numbers of the annual species (particularly sand gilia) fluctuate substantially each year, probably tied to rainfall levels. If any species' numbers fall below 250 individuals, then replanting shall occur the following winter season after the reason(s) for mortality is carefully analyzed and remedied.

Smith's Blue Butterfly: Restoration efforts at the Marina Dunes Preserve will substantially improve potential and existing habitat for the Smith's Blue Butterfly. In addition to the eradication of non-native species and sand stabilization efforts, it is recommended that dune buckwheat *(Eriogonum parvifolium*) be planted at the site to restore the species to the site. Because dune and coast buckwheat (*Eriogonum latifolium*) flower at separate times, they should be planted in large colonies, rather than interspersed, to avoid confusion to the butterfly population that has evolved to use the coast buckwheat.

Black legless lizard: Restoration at the Marina Dunes Preserve will enhance existing poor quality habitat, stabilize and vegetate the sand sheets, and naturally increase black legless lizard populations. The entire parcel will eventually become a habitat corridor for the lizard, allowing movement between lizard populations to the north and south. Lizards disturbed during sand excavation (see Sand Recontouring and Augmentation) will be relocated to established vegetation on site.

Western snowy plover: Any sand stabilization and re-vegetation in the foredune of the Marina Dunes Preserve shall be done in sections with un-vegetated areas in between, to allow potential habitat for the snowy plover. Interpretive signs about the plover and a "dogs on leash" policy are important efforts. If any nesting activity is observed, exclusionary fencing around the nest may be recommended, after contact with local experts. MPRPD may wish to contribute to the regional effort to control the non-native red foxes that prey on the snowy plover.

15. Irrigation:

- To supplement inconsistent rainfall and ensure plant establishment if hydroseeding or outplanting do not occur during December and January.

Because restoration at the Preserve is not dependent on construction schedules, supplemental irrigation should not be necessary. The lack of an irrigation system substantially reduces costs, annual weed proliferation and uncontrolled leaks (Ferreira and Gray, 1987). Instead, a multi-year seeding and planting effort within the appropriate restoration timing window should balance any years of lean rainfall.

The local weather conditions shall be used to best advantage. If broadcast seeding occurs October-November, hydroseeding or straw crimping by end November, and outplanting of seedlings from January through mid-February, the average winter rainfall is usually adequate for successful plant establishment. Hand or truck watering of out-planted seedlings is inconvenient but increases survival if there are rain-free periods of more than two to three weeks in the winter, or sustained high winds unaccompanied by rainfall.

Temporary irrigation may be advisable when the largest areas of the moving sand sheet are stabilized and seeded/ planted in Years Two and Three. Depending on the success of the early experimental treatments at the origin of the sand sheets, it may be deemed

advantageous to extend the native species establishment window with irrigation from December through May.

16. Monitoring:

- To monitor implementation of the restoration plan.
- To ensure that minimum performance criteria are met.

The restoration goal is to create a diversified palette of coastal strand and scrub species that are surviving, growing, and reproducing within five years (i.e. self-sustaining). A project biologist shall oversee all restoration activities to ensure compliance with the restoration plan. The biologist shall also routinely inspect the restoration areas to notice any developing problems, such as increased herbivory, lack of water, or water and wind erosion. Changes to the restoration plan due to adaptive management shall be agreed to by MPRPD and the City of Marina, unless they involve special status species. If special status species are involved, the California Department of Fish and Game and the U.S. Fish and Wildlife Service shall be consulted.

Monitoring standards provide a means for assessing the success of the restoration and for identifying maintenance needs. Annual monitoring shall include quantitative measures to ensure adequate establishment of the native species, including vegetative cover and density (the number of native plants per square meter). The number of species in a given area (species composition or “richness”) shall be calculated to ensure adequate species diversity. Qualitative evaluations shall assess the health and vigor of the vegetation and indicate any erosion or problem areas. Photos taken from permanent photopoints will provide documentation of the progress of restoration. The condition of physical structures such as fences, gates and signs will be evaluated.

Quantitative measurements shall include percent vegetative cover from 30 line transects of 25 meters each (15 permanent, 15 random). There shall be 10 transects per foredune (primarily coastal strand and bluffs), 10 transects per mid-dune (coastal scrub, swales) and 10 transects per reardune areas (primarily coastal scrub and sand blowout areas). Percent cover will be calculated by measuring the distance covered (basal measurement) by any species along 10 randomly placed meter sticks placed perpendicularly to the transect line. The data will be used to estimate the mean percent cover for native and non-native species. The goal of the permanent transects is to monitor the change in percent cover of all native and non-native species over time. The goal of the random transects is to estimate the mean percent cover for native and non-native species with a 95% confidence interval no greater than 25 % of the mean.

Plant density and species richness will be determined from 30 random quadrats, 5*5 meters each, divided evenly between foredune, mid-dune, and reardune areas. Plant density will be figured by presence or absence of a native species (measuring at least 10 cm. basal diameter) for each square meter within the quadrat. Using the same quadrats, species richness shall be assessed for the foredune, mid-dune and reardune areas by recording the number of different native species per 25 square meters and combining the 10 quadrats for richness per 250 square meters.

Monitoring shall occur annually for five years for each 20 acre section following complete restoration. Because of multi-year restoration efforts, the first restoration area may be monitored for 2 years before the final stage is complete. Data shall be collected in May - June when all plant species are at peak growth. Results from the data shall be presented in an Annual Monitoring Report due by September 1 to MPRPD and the City of Marina.

The restored habitat areas shall be maintained and managed to meet the following performance criteria. If an area fails to meet the stated requirements, remedial actions shall be described in the annual report and completed prior to monitoring the following year. The determination of the success of the restoration goals and objectives shall be made by MPRPD, the City of Marina, the California Department of Fish and Game and the U. S. Fish and Wildlife Service.

17. Native Species Performance Criteria:

		Foredune	Mid-to-Reardune
% native cover:	1 year:	>5%	>10%
	2 years:	>10%	>20%
	3 years:	>15%	>25%
	4 years:	>20%	>30%
	5 years:	>25%	>35%
% non-native cover:	All Years	<10%	<10%
Density:	5 years	1 plant greater than 10cm diameter/sq. meter	
Diversity:	5 years	30/250m^2	40/250m^2 (mid) 50/250m^2 (rear)
Special status species:	1000 each: sand gilia, Monterey spineflower, Yadon's wallflower		
Health and vigor:	normal		
Erosion/disturbance:	minimal or nonexistent, repaired in timely manner		
Fences, gates, signs:	in good repair		

18. Contingency Measures:

By the third year, replanting shall occur in deficient areas where native vegetation falls below 15% (foredune) or 25% cover (mid-to-reardune). Reseeding/replanting shall also occur in bare sand areas exceeding 250 square meters, or if species composition falls below 25 species by the third year. Plant failure should trigger careful consideration of the reason(s) for mortality and the appropriate location for the species. If certain species will not survive in exposed areas of the parcel, than any successfully established species from that area shall be increased in number.

The moving sand sheet at the Marina Dunes Preserve has been unvegetated for many years, according to aerial photos. It is likely that stabilization and seeding/ planting treatments will be difficult to impossible as the sands are unconsolidated, with little to no mycorrhizae or nutrients available to plant roots. The sand sheet areas may need to be monitored separately from the other dune restoration areas, and assessed more realistic performance standards.

19. Maintenance:

- To ensure that the goals and objectives of the restoration plan are achieved.
- To ensure that performance criteria are sustained in perpetuity.

Maintenance activities include weed and rodent control, prevention and repair of any disturbance including erosion, replanting of deficient plant areas, fence, gate, or sign adjustment or replacement, and trash collection. Maintenance activities shall be performed by trained staff familiar with native species and the fragility of coastal dune habitat.

Herbicide treatment of non-native species at the proper time can eliminate hours of hand labor. Hand weeding shall be timed to occur before seed is dispersed, with extra weeding labor scheduled for the spring. The removal of iceplant seedlings is important to prevent re-colonization of the species. Ripgut brome is highly invasive in disturbed areas (particularly dead iceplant) and must be thoroughly eliminated before the seed disperses for many years. European beach grass requires constant vigilance to prevent reinvasion. Excessive gopher or squirrel populations should be controlled to prevent loss of the re-vegetation effort.

Eroded or disturbed areas larger than 250 square meters shall be stabilized and replanted. Smaller areas should regenerate from natural seed dispersal. Damaged fencing or signage shall be immediately repaired or replaced. Trash collection in areas without walkways may only need to be performed on a quarterly or semi-annual basis.

In the future, surface or underground improvements may require maintenance or repair in the restoration areas. MPRPD shall approve any work that disturbs the restored habitat areas under the conditions that the dune habitat be protected and any disturbance restored to its original condition. All work is subject to the restoration, maintenance and monitoring provisions in this document.

20. Interpretive Signage:

- To educate about the fragile nature and features of coastal dune habitat;
- To educate about the flora and fauna of the Marina Dunes;
- To guide pedestrians to the beach and discourage entry into restored areas.

To enhance visitor appreciation and enjoyment of the Marina Dunes and the Monterey Bay, educational information about the coastal dune habitat shall be displayed and updated on several kiosks placed at each gate along Dunes Drive **(Fig. 7)**. The interpretive text shall discuss habitat restoration on the site, with information about the Marina Dunes and its inhabitants, including illustrations of several common and endangered dune species. Ocean safety information is already posted at a central location above the beach. If this sign does not include information about the western snowy plover and its beach habitat, then it should be updated. Additional ocean safety signs are suggested at the end of the central pathway to the beach **(Fig. 6)**. All interpretive signs shall be made of a material that resists damage by vandals and the weather, and the posts secured by concrete footings. No signs should be installed on the beach.

As budget permits, additional interpretive signs might identify various dune species along the access trails to the beach by picture and brief description. In particular, all three special status species (sand gilia, Monterey spineflower, and Yadon's wallflower) should be identified along the central pathway to the ocean, which passes alongside suitable or existing habitat for each of the species **(Fig. 7)**.

Signs prohibiting entry might say "Sensitive Habitat–Please Do Not Enter" or "Restoration in progress- Please Do Not Enter" should be placed at the edges of the restoration areas. In the appropriate areas, signs reading "Please do not disturb, restoration by volunteers" seem to be most effective. Strategically placed "Beach Access" signage shall direct pedestrians to the walkways to prevent shortcuts through the restoration areas.

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Table 1a. Native Species

Scientific Name		Common Name	06/15/05
Abronia latifolia		yellow sand verbena	x
Abronia umbellata		pink sand verbena	x
Achillea millefolium		yarrow	x
Agoseris apargioides var. eastwoodiae		Eastwood's agoseris	x
Ambrosia chamissonis		beach burr	x
Armeria maritima		sea thrift	x
Artemisia californica		CA. Sagebrush	
Artemisia pycnocephala		sagewort	x
Astragalus nuttallii		rattleweed	
Atriplex leucophylla		saltbush	
Baccharis pilularis		coyote bush	x
Cakile maritima		sea rocket	x
Calystegia soldanella		beach morning glory	x
Camissonia cheiranthifolia		beach primrose	x
Cardionema ramossisimum		sand mat	x
Castilleja latifolia		Indian paintbrush	x
Chorizanthe pungens	FT*	Monterey spineflower	x
Crassula connata		sand pgymy	x
Croton californicus		croton	x
Cryptantha leiocarpa		coast cryptantha	
Cupressus macrocarpa		Monterey cypress	15
Dudleya caespitosa		liveforever	x
Ericameria ericoides		mock heather	x
Erigeron glaucus		seaside daisy	
Eriogonum latifolium		coast buckwheat	x
Eriogonum parvifolium		dune buckwheat	
Erysimum ammophilum		coast wallflower	x
Erysimum menziesii ssp. yadonii	CE, FE*	Yadon's wallflower	x
Eriophyllum staechadifolium		lizardtail	x
Eschscholzia californica var. maritima		CA. poppy	x
Gilia tenuiflora ssp. arenaria	CT, FE*	sand gilia	151
Heterotheca grandiflora		telegraph weed	x
Lessingia filaginifolia		CA. beach aster	x
Leymus mollis		American dune grass	
Linaria canadensis		blue toad-flax	
Lotus scoparius		deerweed	x
Lupinus chamissonis		silver beach lupine	x
Phacelia ramosissima		branching phacelia	x
Poa douglasii		sand dune bluegrass	x
Polygonum paronychia		knotweed	x
TOTAL		Species	30

*CE/CT = CA Endangered/Threatened
FE/FT = Federally Endangered/Threatened

Table 1b. Non-Native Species

Non-Native Species Scientific Name	Common Name	Present 06/15/05
Acacia spp.	acacia	1
Ammophila arenaria	Holland dune grass	x
Anagallis arvensis	scarlet pimpernel	x
Avena fatua	wild oat	x
Brassica nigra	black mustard	x
Bromus diandrus	ripgut grass	x
Carpobrotus edulis	iceplant	30-100%
Chamomilla suavelens	pineapple weed	
Centaurea melitensis	tocalote	x
Conicosia pugioniformis	conicosia	
Conyza canadensis	horseweed	x
Erodium cicutarium	redstem storksbill	x
Eucalyptus globulus	blue gum	30
Gnaphalium luteo-album.	weedy cudweed	
Hordeum murinum	barnyard foxtail	
Hypochaeris glabra	smooth cat's ears	
Medicago polymorpha	California burrclover	
Melilotus indica	Indian melilot	
Pennisetum clandestinum	kikuyu grass	
Plantago coronopsis	cut-leaved plantain	
Poa annua	annual bluegrass	
Polypogon monspeliensis	rabbitfoot grass	
Raphanus sativa	wild radish	
Rumex acetosella	sheep sorrell	
Senecio vulgaris	common butterweed	
Silene multinervia	many-nerved catchfly	
Solanum umbelliferum	nightshade	
Sonchus oleraceus	common sowthistle	
Spergularia bocconii	sand-spurrey	
Stellaria media	shiny chickweed	
Tetragonia tetragonioides	New Zealand spinach	x
Vulpia myuros	rattail fescue	
TOTAL	Species	12

Table 2. Proposed Native Species and Seed Requirements

				Pounds of Seed				
Scientific Name	**Common Name**	Spp %	Contain.	Seed/Cont	Broadcast	Hydro-	Crimp.	TOTAL
Abronia latifolia	yellow sand verbena	5%	**2000**	15	50	Mid-Rear		65
Abronia umbellata	pink sand verbena	3%	**1400**	8	40		20	68
Achillea millefolium	yarrow	2%	**900**	2	13	5	6	26
Agoseris apar. var. eastwoodiae	Eastwood's agoseris	1%	**500**	1	8	2	3	13
Ambrosia chamissonis	beach burr	5%	**2300**	13	75		20	108
Armeria maritima	sea thrift	2%	**900**	3	12	5	6	26
Artemisia californica	CA. Sagebrush	3%	**1200**	2	23	5	9	38
Artemisia pycnocephala	sagewort	14%	**6000**	14	150	25	50	239
Astragalus nuttallii	rattleweed	3%	**1400**	3	23	5	9	39
Atriplex leucophylla	saltbush							
Baccharis pilularis	coyote bush	2%	**900**	2	15	3	6	26
*Cakile maritima**	sea rocket	Non-inv.						
Calystegia soldanella	beach morning glory							
Camissonia cheiranthifolia	beach primrose	3%	**500**	1	25	6	10	42
Cardionema ramossisimum	sand mat							
Castilleja latifolia	Indian paintbrush	1%	**500**	1	8	2	3	13
Chorizanthe pungens (FT)	Monterey spineflower	4%	**1000**	2	50	8	15	75
Crassula connata	sand pgymy							
Croton californicus	croton							
Cryptantha leiocarpa	coast cryptantha							
Cupressus macrocarpa	Monterey cypress	PB End.						
Dudleya caespitosa	liveforever	2%	**900**	1	4	1	2	8
Ericameria ericoides	mock heather	7%	**3000**	7	53	11	22	92
Erigeron glaucus	seaside daisy	2%	**900**	3	14	3	6	26
Eriogonum latifolium	coast buckwheat	6%	**2400**	10	50	20	40	120
Eriogonum parvifolium	dune buckwheat	4%	**1800**	4	26			30
Erysimum ammophilum	coast wallflower	3%	**1400**	3	24	5	10	42
Erysimum m. ssp. yadonii (CE, FE)	Yadon's wallflower	5%	**3000**	3	10			13
Eriophyllum staechadifolium	lizardtail	6%	**2500**	6	50	14	30	100
Eschscholzia cal. var. maritima	CA. poppy	3%	**1400**	1	15	8	12	36
Gilia ten. ssp. arenaria (CT, FE)	sand gilia	2%	**3000**	0.5				1
Heterotheca grandiflora	telegraph weed							0
Lessingia filaginifolia	CA. beach aster	3%	**1400**	2	10	2	4	18
Leymus mollis	American dune grass							
Linaria canadensis	blue toad-flax							
Lotus scoparius	deerweed	2%	**900**	5	40	10	20	75
Lupinus chamissonis	silver beach lupine	3%	**1200**	1	8	4	6	19
Phacelia ramosissima	branching phacelia	1%	**300**	1	8	2	3	13
Poa douglasii	sand dune bluegrass	3%	**1400**	rhizomes				30
Polygonum paronychia	knotweed							
TOTAL	**Species**	**100%**	**45,000**	**100**	**750**	**150**	**300**	**1400**

Table 3. Appropriate Ecotype for Seeding/ Outplanting

Scientific Name	Common Name	strand	bluff	scrub	Rear ridges	Sand sheets	Maritime chaparral	paths
Abronia latifolia	yellow sand verbena	X	X		*X*			
Abronia umbellata	pink sand verbena			X				
Achillea millefolium	yarrow		X	X	*X*			
Agoseris apargioides var. eastwoodiae	Eastwood's agoseris	X						
Ambrosia chamissonis	beach burr	X		X	*X*	X		
Armeria maritima	sea thrift	X		X				
Artemisia californica	CA. Sagebrush						X	
Artemisia pycnocephala	sagewort	X	X	X	*X*	X		X
Astragalus nuttallii	rattleweed		X	X	*X*			
Atriplex leucophylla	saltbush	X						
Baccharis pilularis	coyote bush						X	
Cakile maritima	sea rocket				*X*	X		
Calystegia soldanella	beach morning glory	X						
Camissonia cheiranthifolia	beach primrose	X		X	*X*			X
Cardionema ramossisimum	sand mat			X				X
Castilleja latifolia	Indian paintbrush		X	X	*X*			
Chorizanthe pungens (FT)	Monterey spineflower	X		X				X
Crassula connata	sand pgymy							
Croton californicus	croton			X				
Cryptantha leiocarpa	coast cryptantha			X				
Cupressus macrocarpa	Monterey cypress							
Dudleya caespitosa	liveforever		X	X	*X*			
Ericameria ericoides	mock heather		X	X	*X*	X	X	
Erigeron glaucus	seaside daisy			X				
Eriogonum latifolium	coast buckwheat		X	X	*X*	X	X	X
Eriogonum parvifolium	dune buckwheat			X	*X*	X	X	X
Erysimum ammophilum	coast wallflower			X				
Erysimum menziesii ssp. yadonii (CE, FE)	Yadon's wallflower	X						
Eriophyllum staechadifolium	lizardtail		X	X	*X*	X		X
Eschscholzia californica var. maritima	CA. poppy	X	X	X				X
Gilia tenuiflora ssp. arenaria (CT, FE)	sand gilia			X				
Heterotheca grandiflora	telegraph weed							
Lessingia filaginifolia	CA. beach aster	X		X	*X*			X
Leymus mollis	American dune grass							
Linaria canadensis	blue toad-flax			X				
Lotus scoparius	deerweed			X		X		X
Lupinus chamissonis	silver beach lupine		X	X	*X*	X		X
Phacelia ramosissima	branching phacelia			X				X
Poa douglasii	sand dune bluegrass	X	X	X	*X*	X		X
Polygonum paronychia	knotweed			X	*X*	X		
TOTAL	**Species**							

Table 4. Restoration Schedule

Marina Dunes Preserve (62 acres)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Weed and rodent control (6-12 mos. prior)		weeds						natives					
Remove debris				pre-planting/ seeding									
Sand recontouring, augmentation							pre-planting/ seeding						
Sand stabilization (straw plugs, drift fencing)					w/in 48 hrs. of disturb.								
Install exclusionary fencing				pre-planting/ seeding									
Seed Collection				GITA, CACH		most dune species			ARCA, BAPI, ERER				
Propagation													
Broadcast seeding													
Mechanical straw crimping													
Hydroseeding													
Outplanting (includes special status spp.)													
Monitoring													
Maintenance/ Weed control	Spray			Hand-weeding									
Installation of Signs (no entry)				post-fence install									
Education/Interpretation				post-planting/ seeding									

Table 5. Multi-Year Budget

										MPRPD	**Trust Fund**
	Material	Quantity	Units	Notes	Cost	Hours	Rate	Cost	**TOTAL**	FY06-09	**FY08-09**
Project Plan				Report	$10,000				$10,000	$5,000	
Construction Debris Removal		100	tons	crew + disposal		60	$750		$45,000		**$25,000**
Sand Recontouring/ Augment		500	cy	Equip+Operator		40	$100		$4,000		**$1,400**
Sand Stabilization	30 ac. highly disturbed + 20 ac. sand sheet + 12 ac. moderately disturbed										
Straw planting (by hand)	Straw	2000	lbs	3-acres	$250	900	$35	$31,500	$31,750	$1,600	**$11,113**
Straw crimping (by machine)	Straw	40000	lbs	20-acres	$5,000	40	$1,375	$55,000	$60,000		**$21,000**
Hydroseeding	Hydroseed	150	lbs	10-acres	$5,250	40	$250	$10,000	$15,250		**$5,338**
Drift fencing	Fencing	6000	ft	incl delivery	$1,500	60	$35	$2,100	$3,600	$2,400	**$1,200**
Protective Fencing	Fencing	3000	ft	incl delivery	$16,000	60	$80	$4,800	$20,800	$1,000	**$7,280**
Herbicide spraying	Chemical	incl	gal	62-acres	incl	440	$80	$35,200	$35,200	$10,000	**$12,320**
Interpretive Signage	Sign/Kiosk	4	ea	Time/Material	$10,000	24	$60	$1,440	$11,440		**$4,004**
Seed Collection	Seed	810	lbs	incl	incl	810	$35	$28,350	$28,350		**$9,923**
Propagation	Cells	65000	ea	1000/acre	$65,000	400	$35	incl	$65,000	$40,000	**$22,750**
Broadcast seeding	Seed	760	lbs	40-acres	incl	76	$35	$2,660	$2,660	$1,200	**$931**
Outplanting	Cells	45000	ea	45-acres	incl	1000	$35	$35,000	$35,000	$21,000	**$12,250**
Irrigation	Unknown - Depends on Rainfall & Timing and could double planting costs										
Project Management	Contract					620	$55	$34,100	$34,100	$3,500	**$11,935**
	Salaried					200	85	$17,000	$17,000	$8,500	
Total Installation Costs	**Less any Irrigation Costs and Contigencies**								$419,150	$94,200	**$146,443**
Annual monitoring & reporting				5-years		500	$55	$27,500	$27,500		
Annual weed control	Chemical	incl	gal	5-years	incl	1100	$80	$88,000	$88,000		
TOTAL from PROJECT ESTIMATE									$534,650	$94,200	**$146,443**
TOTAL from DISTRICT and TRUST FUND									$240,643		

Figure 1.

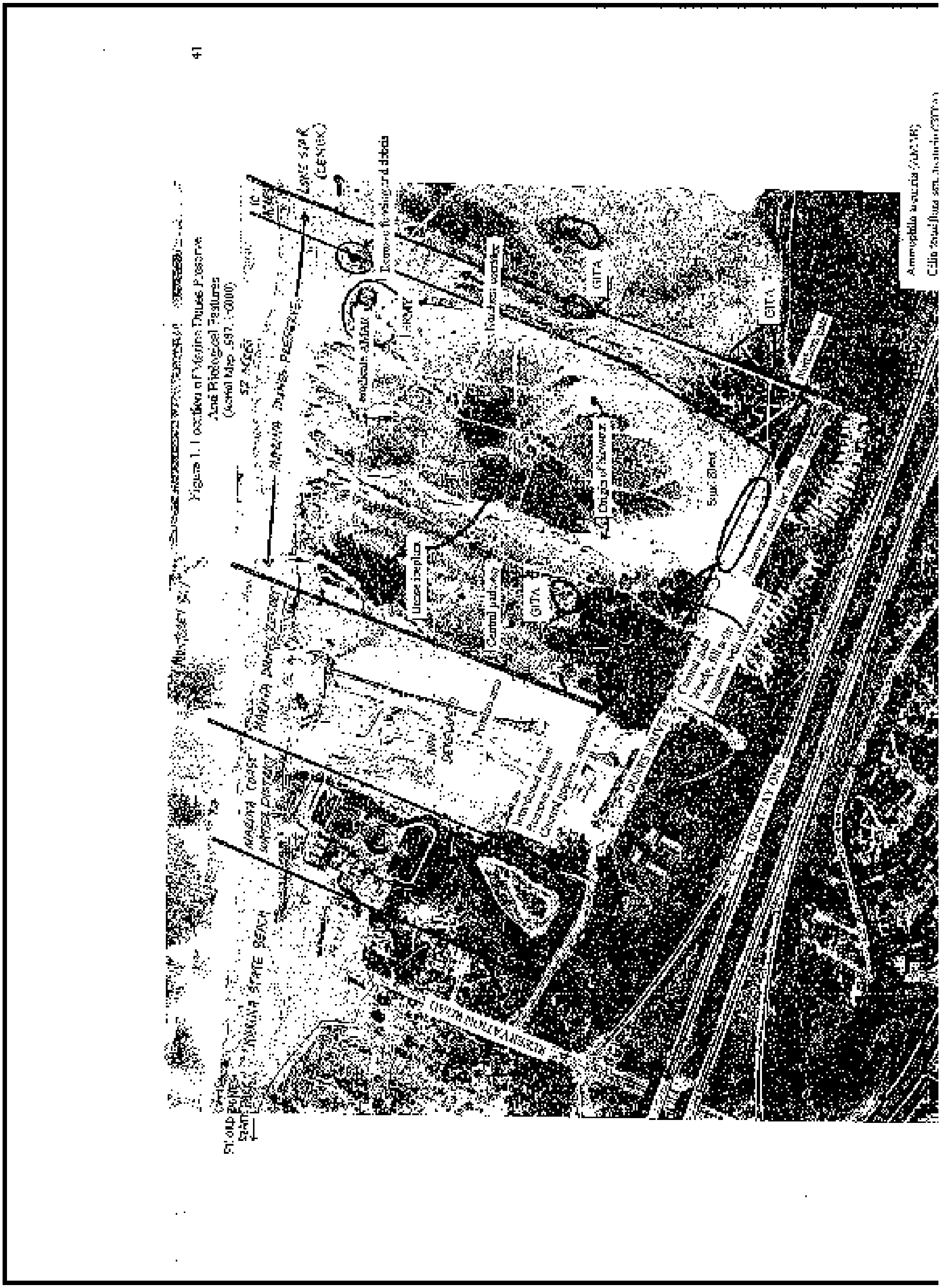


Figure 2. Plant Communities and Rare Species

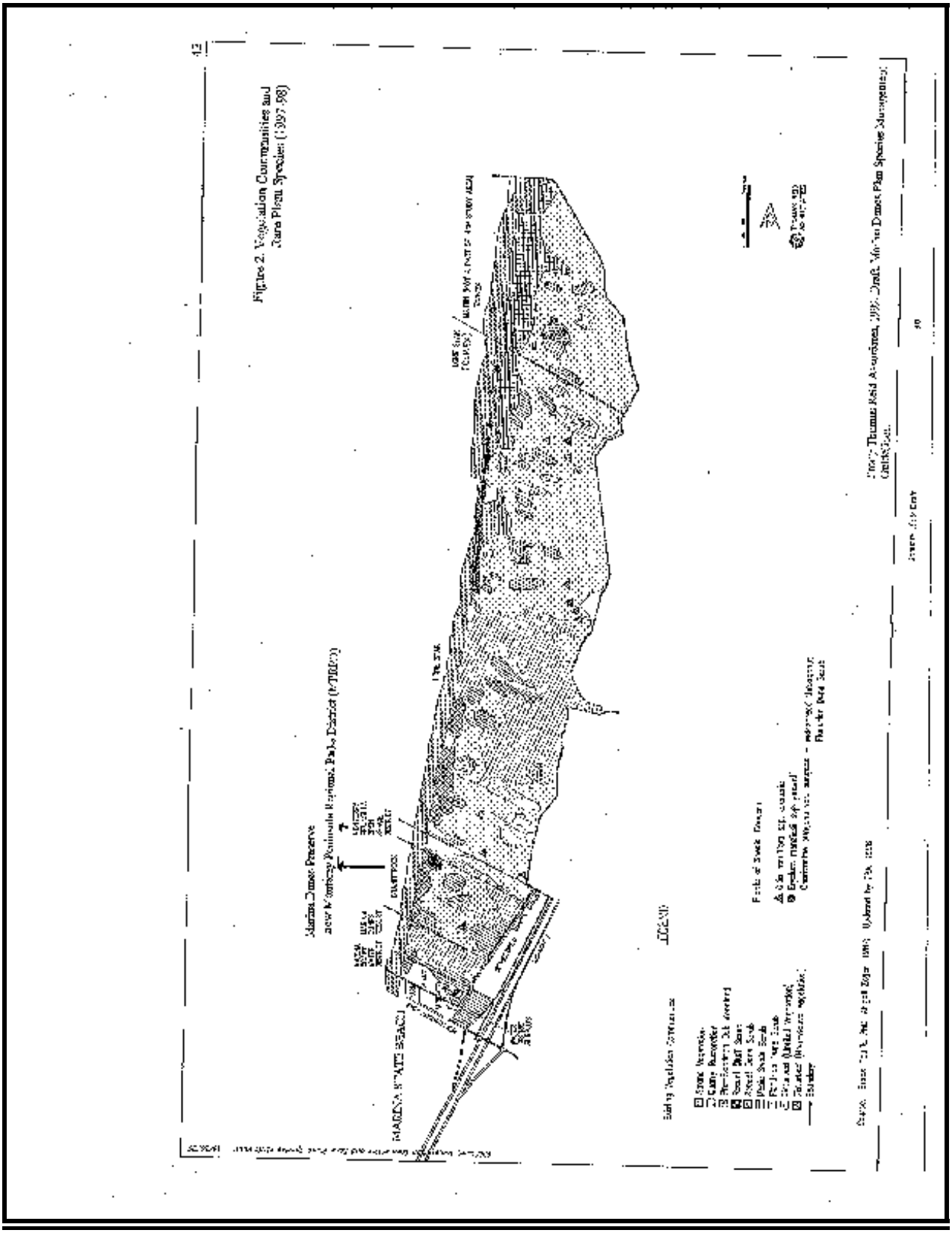


Figure 3. Smith's Blue Butterfly Habitat

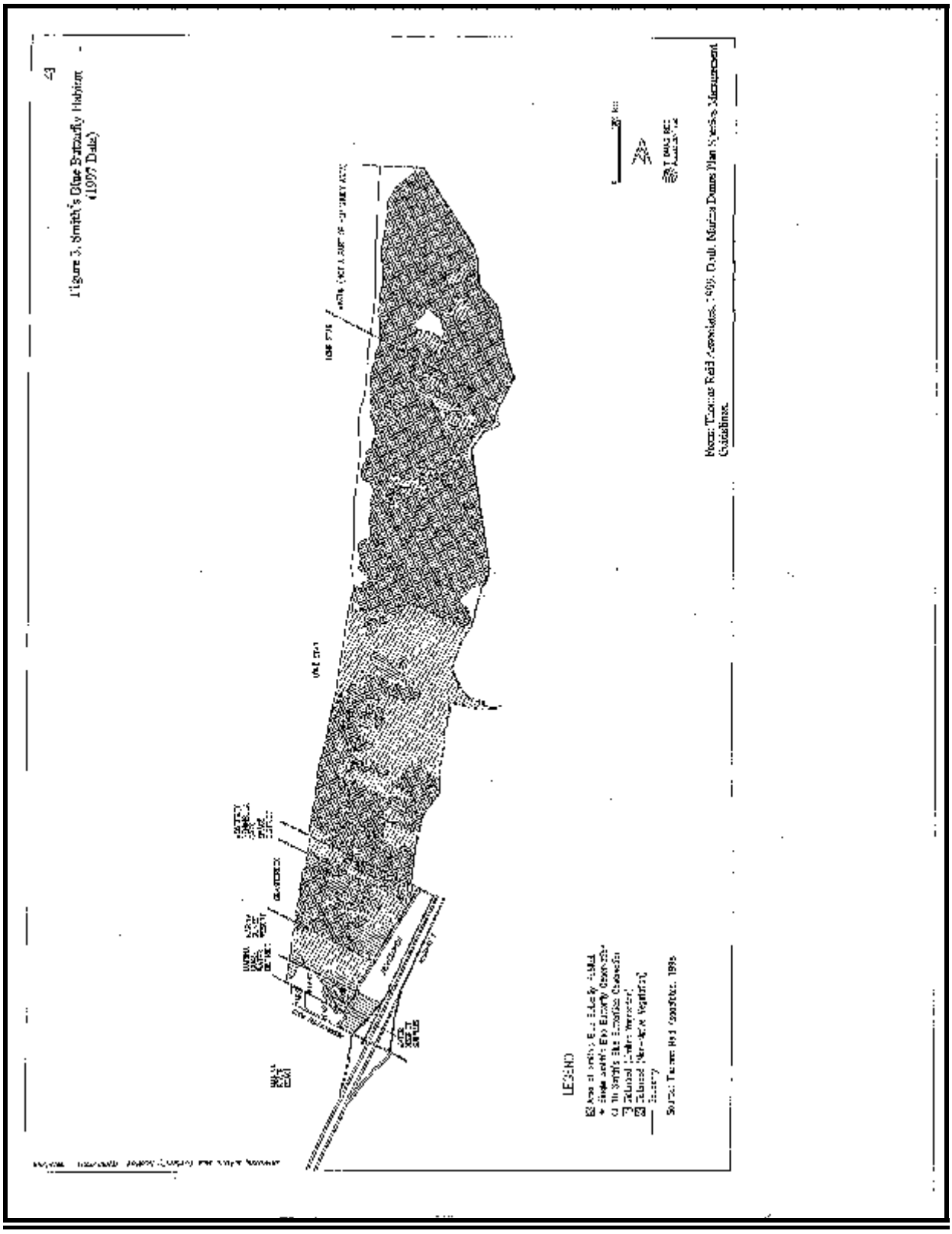


Figure 4. Black Legless Lizard Habitat

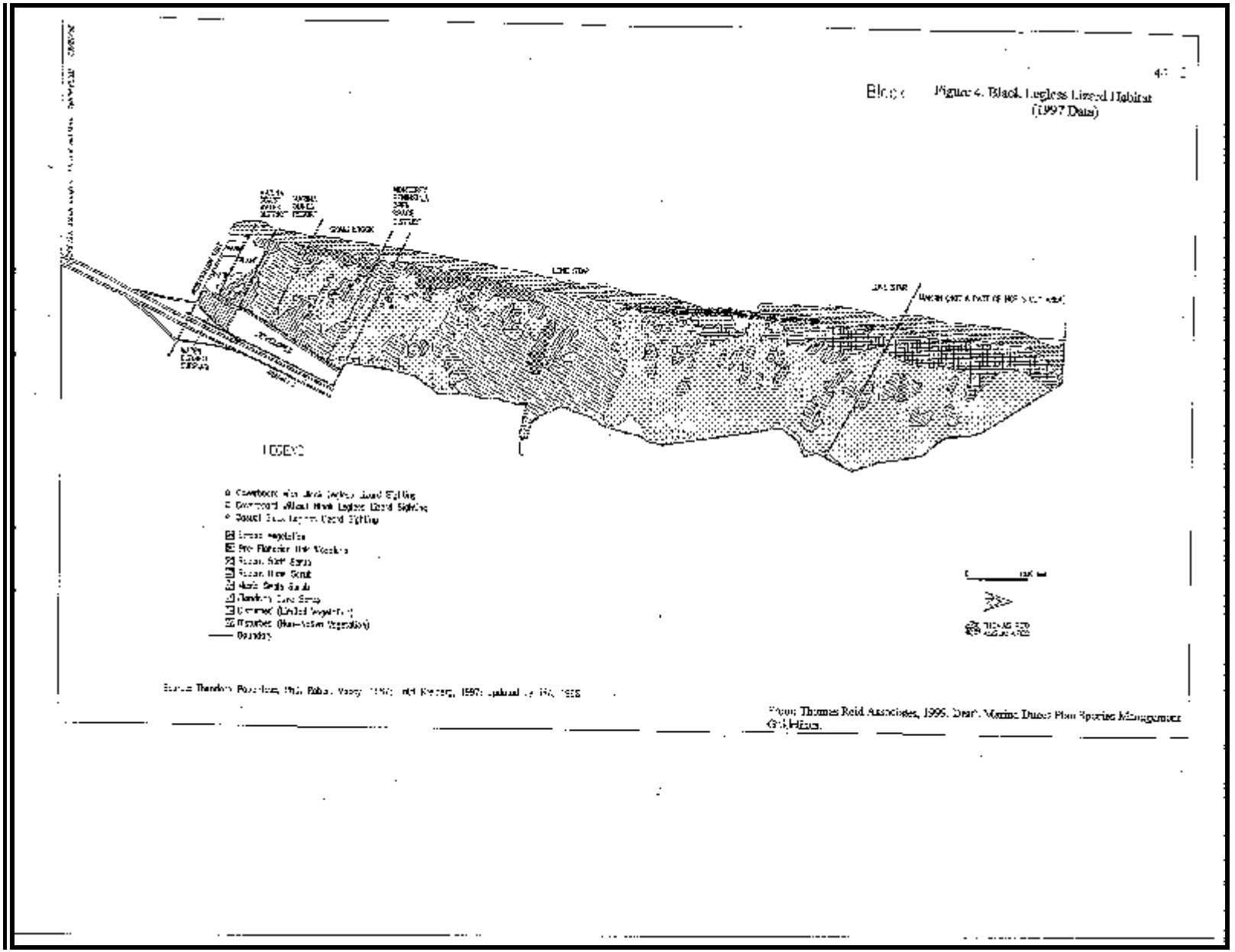


Figure 4. Black Legless Lizard Habitat
(1997 Data)

From: Thomas Reid Associates, 1998. Draft. Marine Dunes Plan Species Management Guidelines.

Figure 5. Snowy Plover Nesting Sites

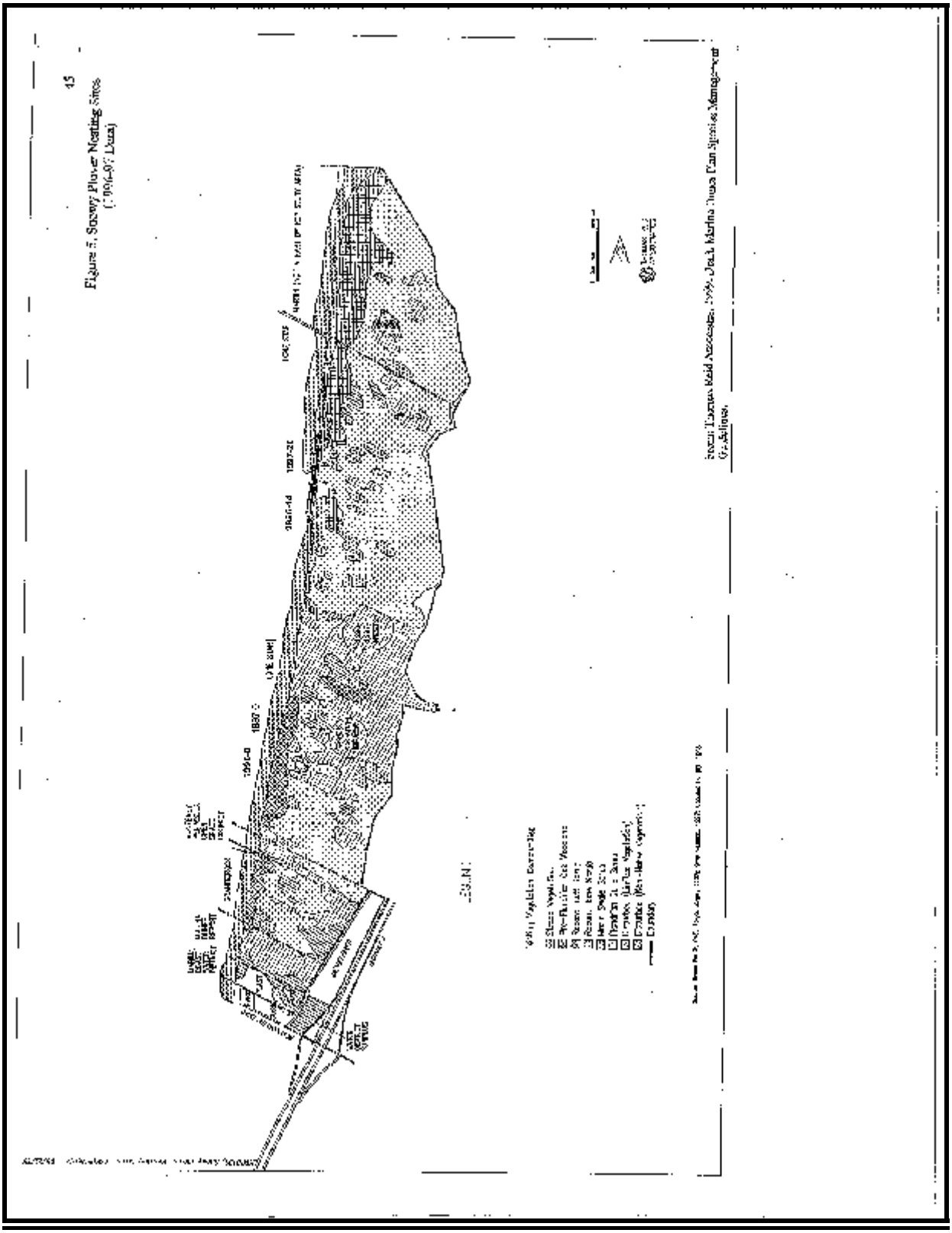


Figure 6. Stabilization and Treatment Areas

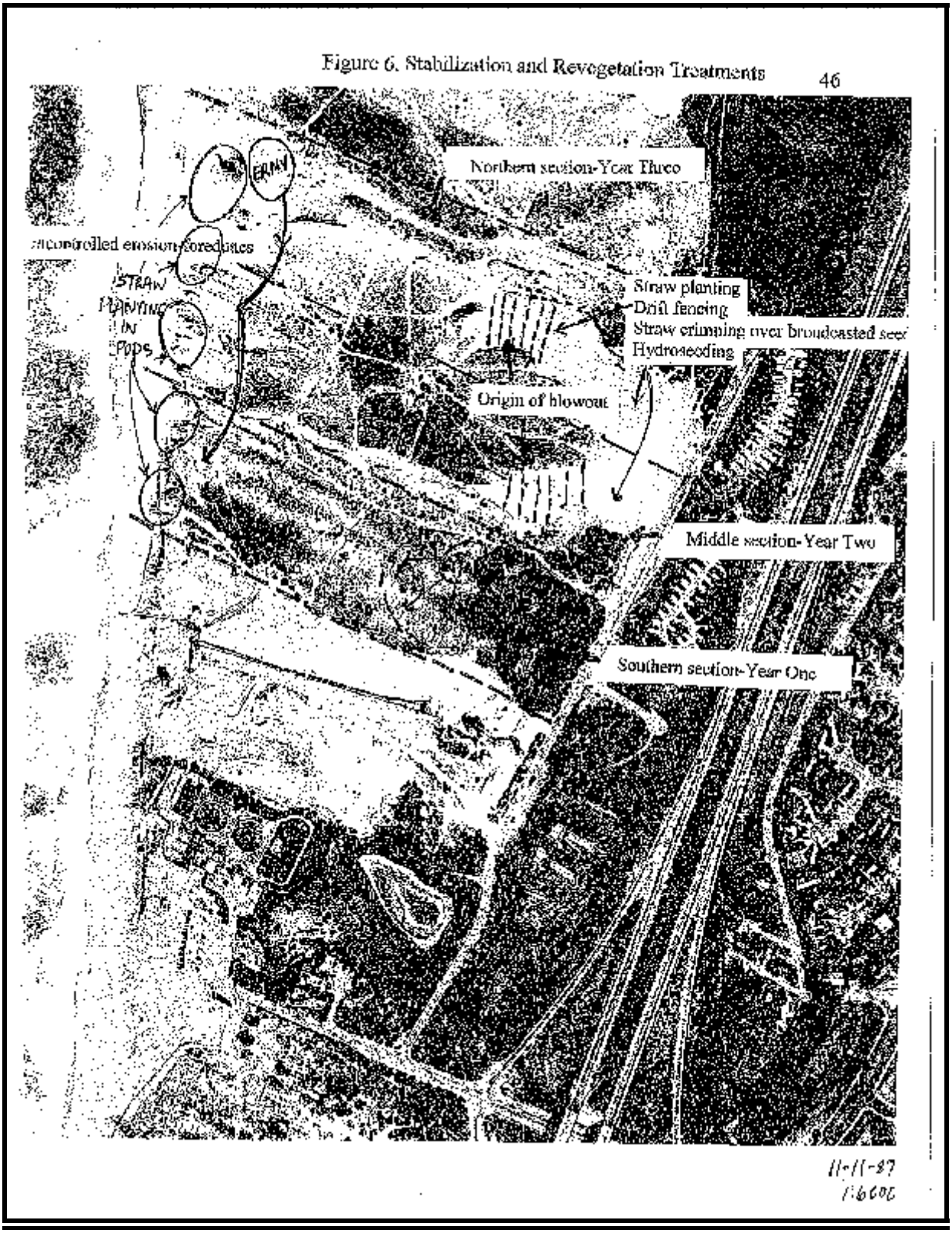
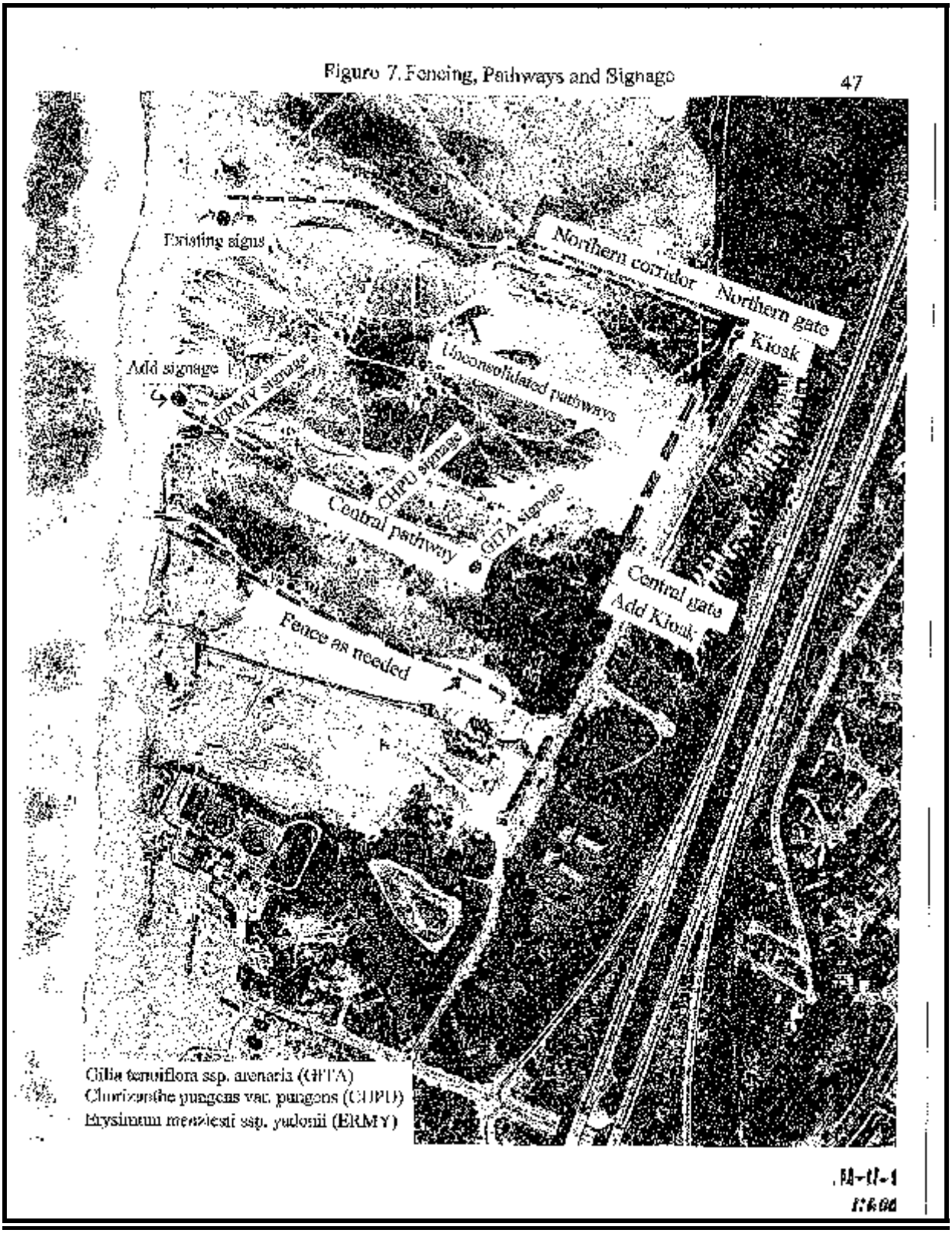


Figure 7. Fencing, Paths, and Signage



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APPENDIX B

Updated Plant List

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The following table is a restructured list of plants included in the 2005 Dune Habitat Restoration Plan for Marina Dunes Preserve that are appropriate for restoration. Scientific names have been revised to follow current nomenclature and common names have been updated to follow those listed in Matthews and Mitchell 2015. Four species (*Cakile maritima*, *Cupressus macrocarpa*, *Eriogonum parvifolium*, *Heterotheca grandiflora*) were removed from the original list. Appropriate quantities of each species for propagation will be determined in the field based on existing vegetation in Restoration Areas.

Table B-1. List of Appropriate Species for Restoration per Dune Zone.

Scientific Name	Common Name	Foredune	Mid Dune	Rear Dune
Abronia latifolia	yellow sand verbena	+	x	
Abronia umbellata	pink sand verbena	+	x	
Achillea millefolium	yarrow		+	x
Acmispon glaber	deerweed		+	x
Agoseris apargioides var. *apargioides*	seaside dandelion	+	x	
Ambrosia chamissonis	beach bur-sage	x	+	x
Armeria maritima ssp. *californica*	sea pink		+	x
Artemisia californica	coast sagebrush			+
Artemisia pycnocephala	coastal sagewort		+	x
Astragalus nuttallii	nuttall's milkvetch		+	x
Atriplex leucophylla	beach saltbush	+		
Baccharis pilularis	coyote brush			+
Calystegia soldanella	beach morning-glory	+		
Camissonia cheiranthifolia	beach evening primrose	+		
Cardionema ramosissimum	sandmat		x	+
Castilleja latifolia	Monterey coast paintbrush		+	x
Chorizanthe pungens var. *pungens* (FT)	Monterey spineflower	x	+	+
Corethrogyne filaginifolia	California sand-aster	x	+	x
Crassula connata	pygmy-weed		x	+
Croton californicus	California croton			x
Cryptantha leiocarpa	beach cryptantha		x	+
Dudleya caespitosa	liveforever		+	x
Elymus mollis ssp. *mollis*	American dune grass	+		
Ericameria ericoides	mock heather		x	+
Erigeron glaucus	seaside daisy		+	
Eriogonum latifolium	coast buckwheat		+	x
Erysimum ammophilum	sand-loving wallflower		+	x
Erysimum menziesii ssp. *yadonii* (CE, FE)	Yadon's wallflower	+		
Eriophyllum staechadifolium	seaside woolly sunflower		x	+
Eschscholzia californica	California poppy	x	+	+
Gilia tenuiflora ssp. *arenaria* (CT, FE)	sand gilia		+	+

Scientific Name	Common Name	Foredune	Mid Dune	Rear Dune
Lupinus chamissonis	silver beach lupine		+	+
Nuttallanthus texanus	blue toadflax			+
Phacelia ramosissima	branching phacelia		+	+
Poa douglasii	sand dune bluegrass	x	+	x
Polygonum paronychia	dune knotweed		+	x

Note: a blue "+" indicates the dune zone where a species primarily occurs. A black "x" indicates other dune zones where a species may occur.
Definitions: FE/FT = Federally Endangered/Threatened; CE/CT = CA Endangered/Threatened.

APPENDIX C

Restoration Area Maps

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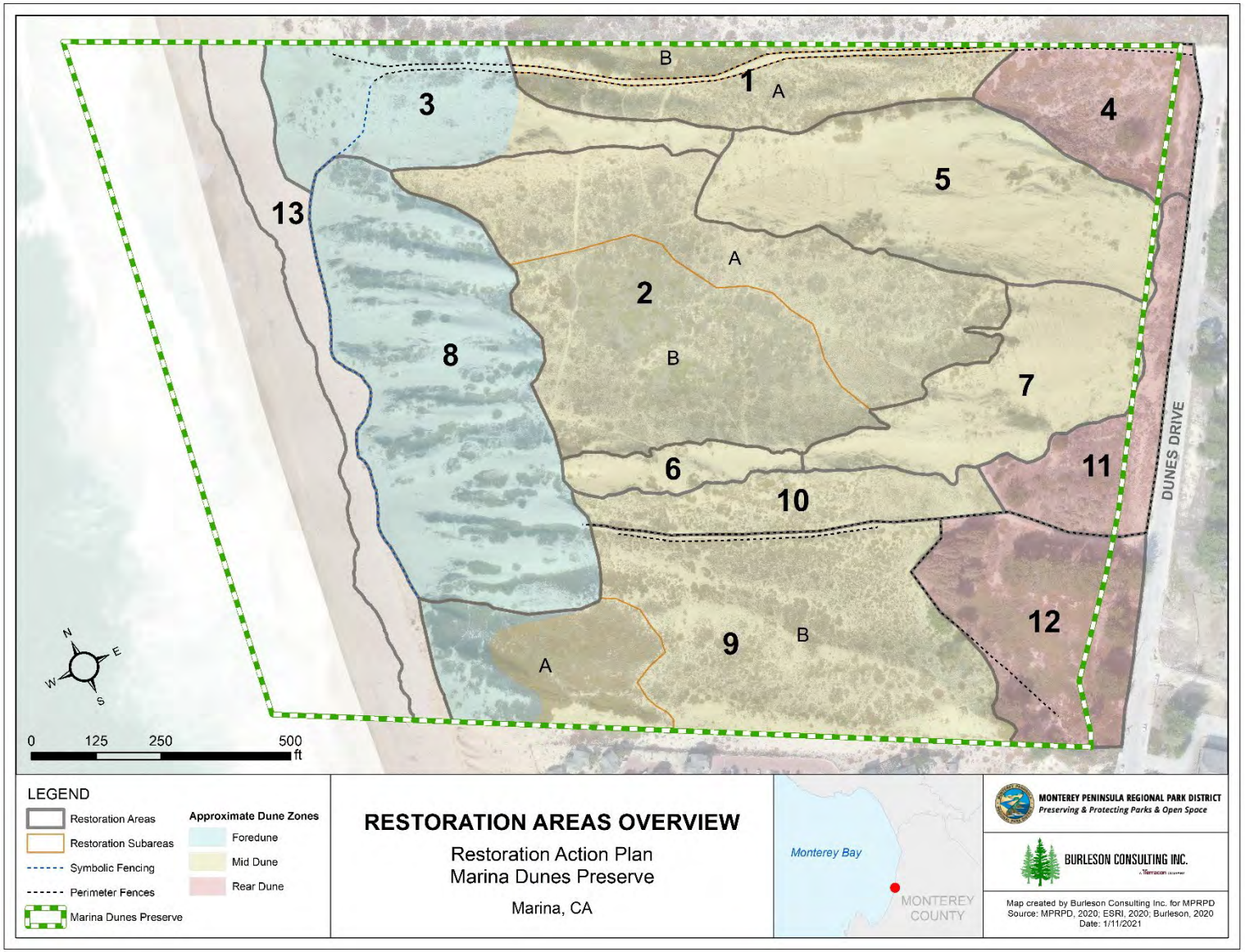

Figure C-1. Restoration Areas overview.

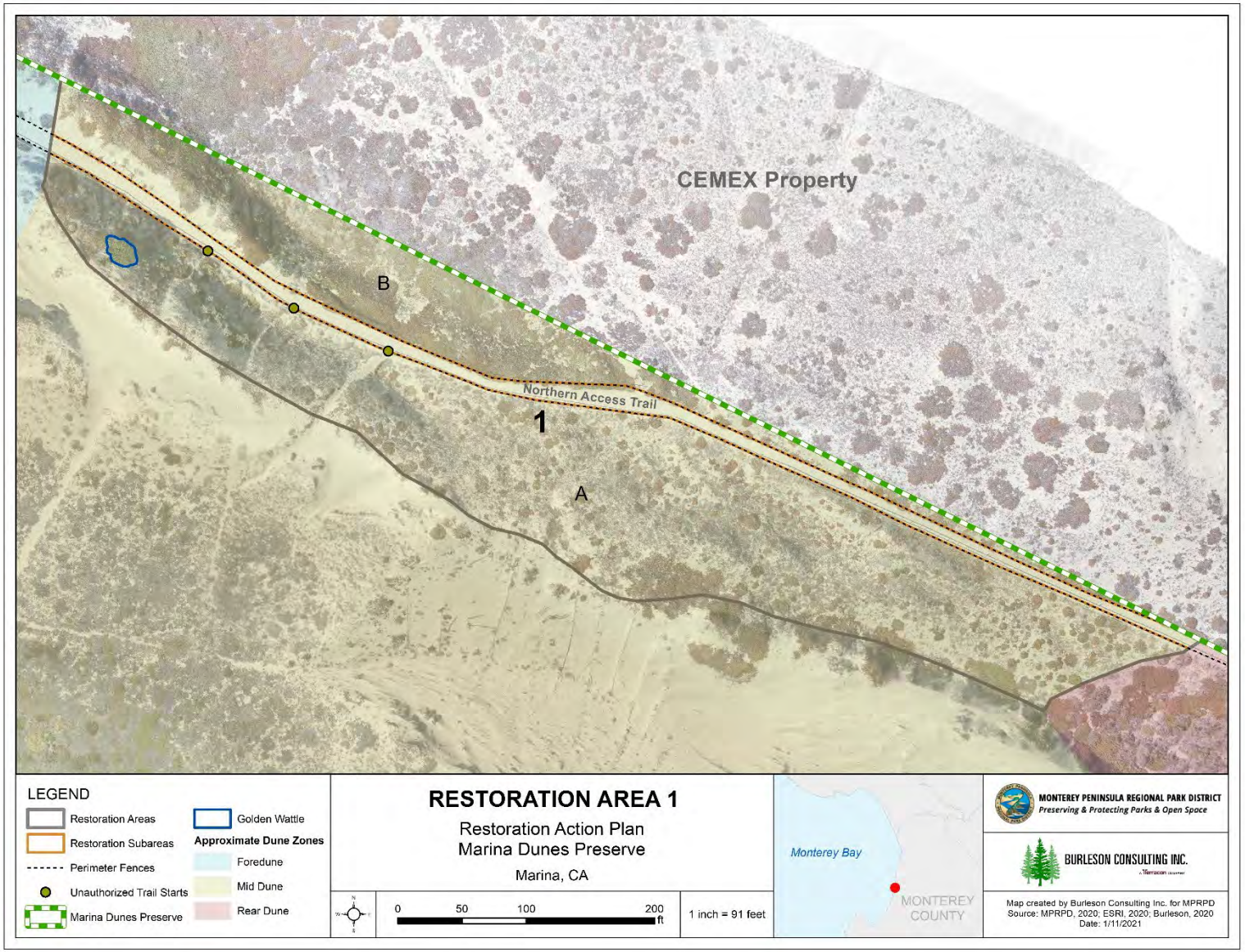

Figure C-2. Restoration Area 1.

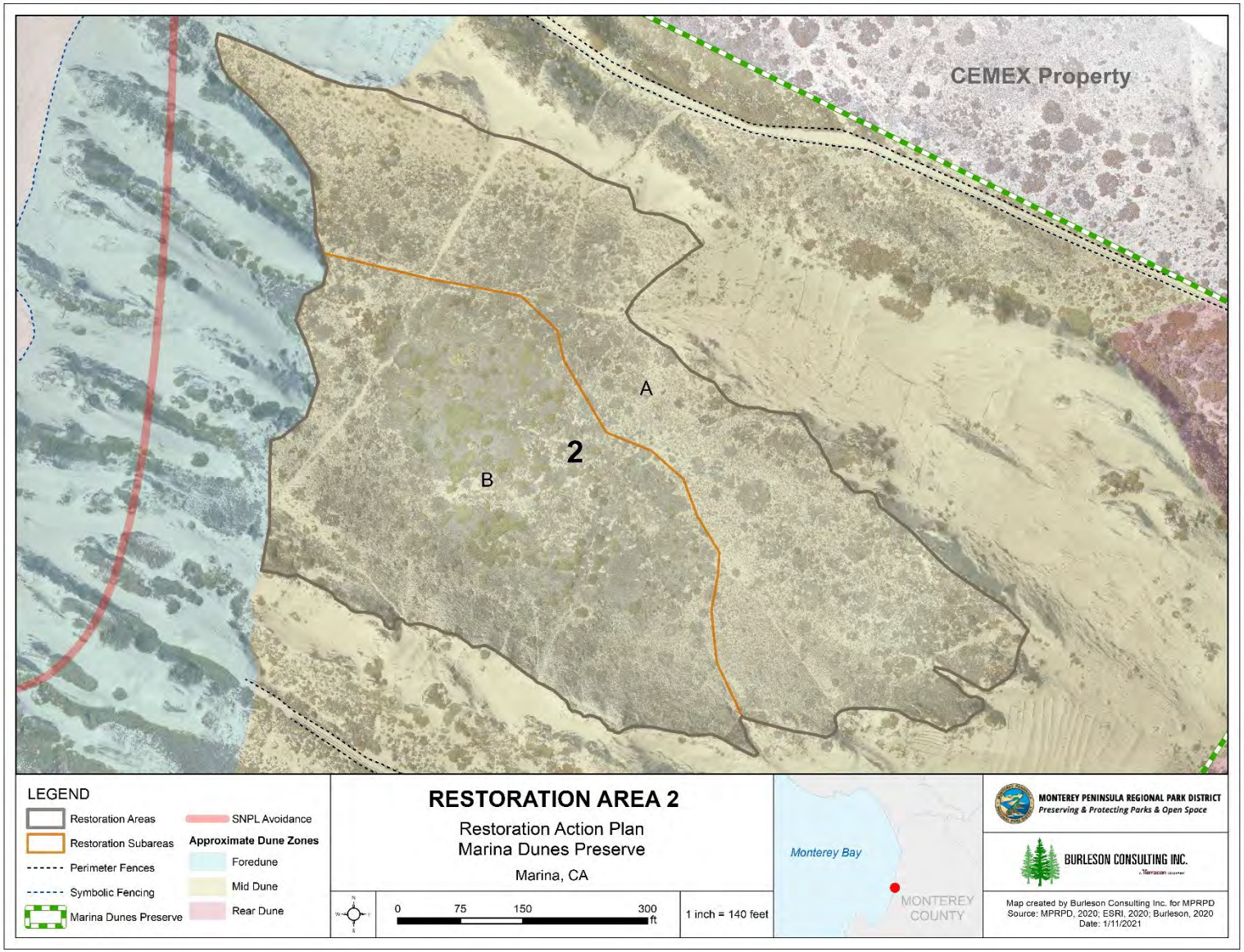

Figure C-3. Restoration Area 2.

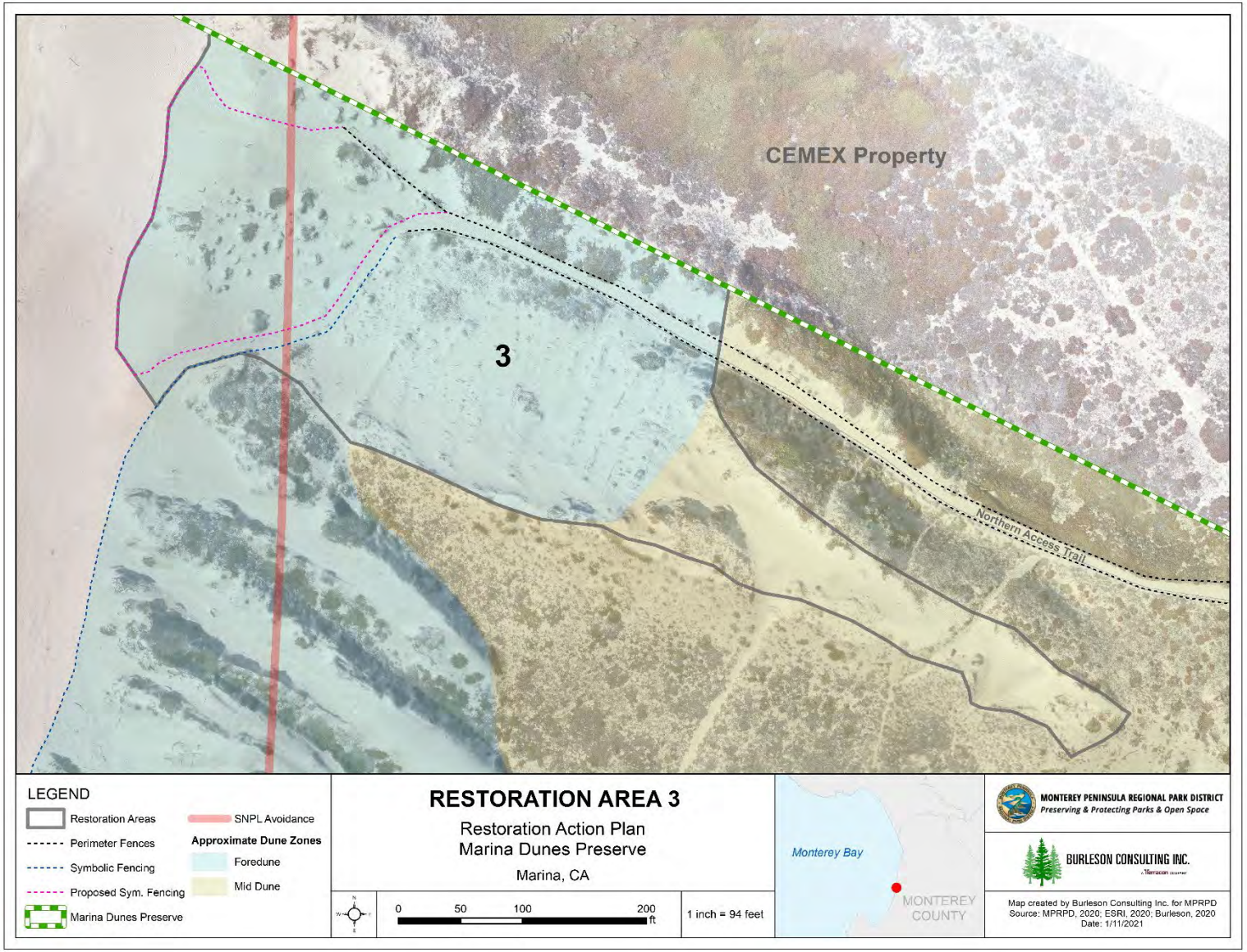

Figure C-4. Restoration Area 3.

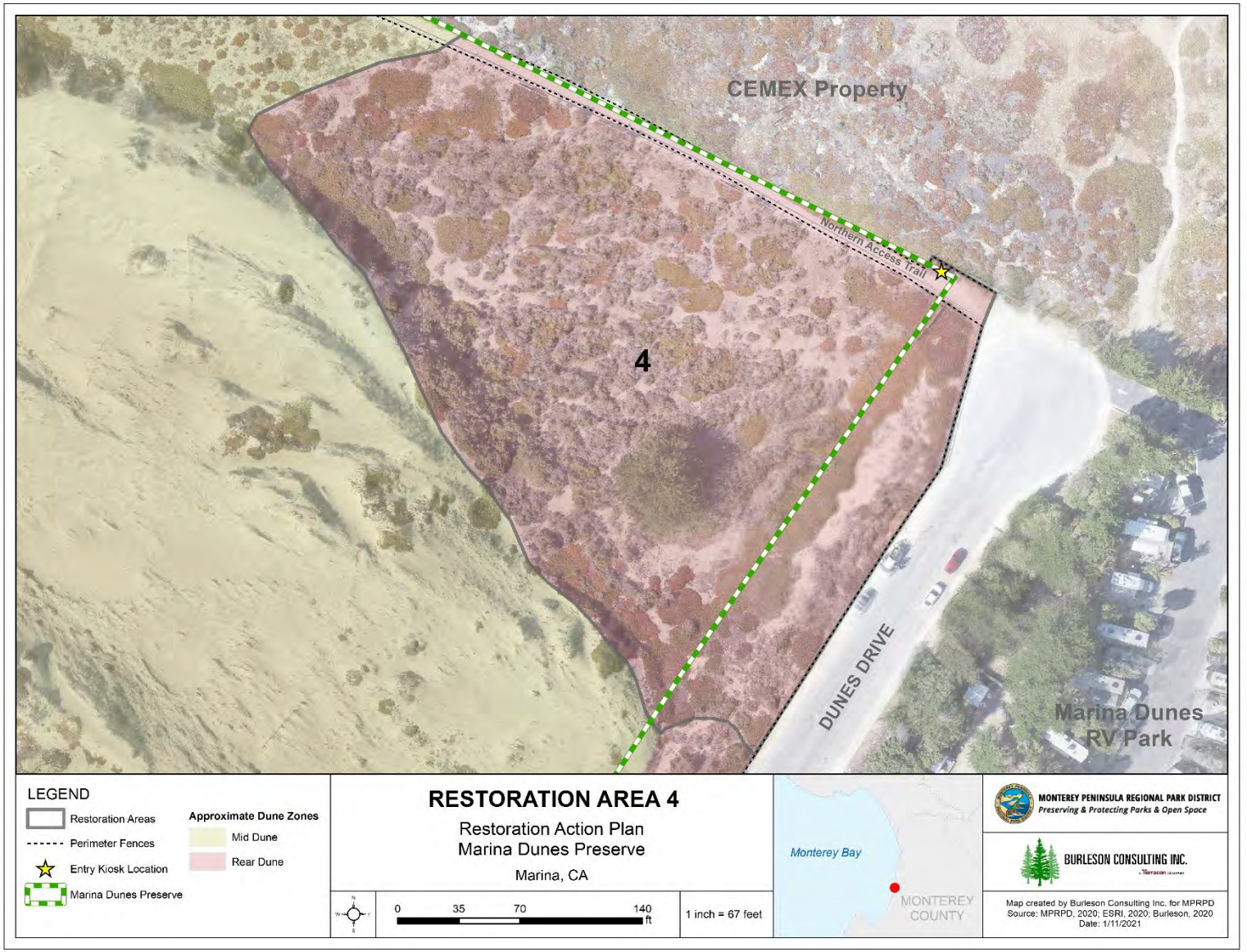

Figure C-5. Restoration Area 4.

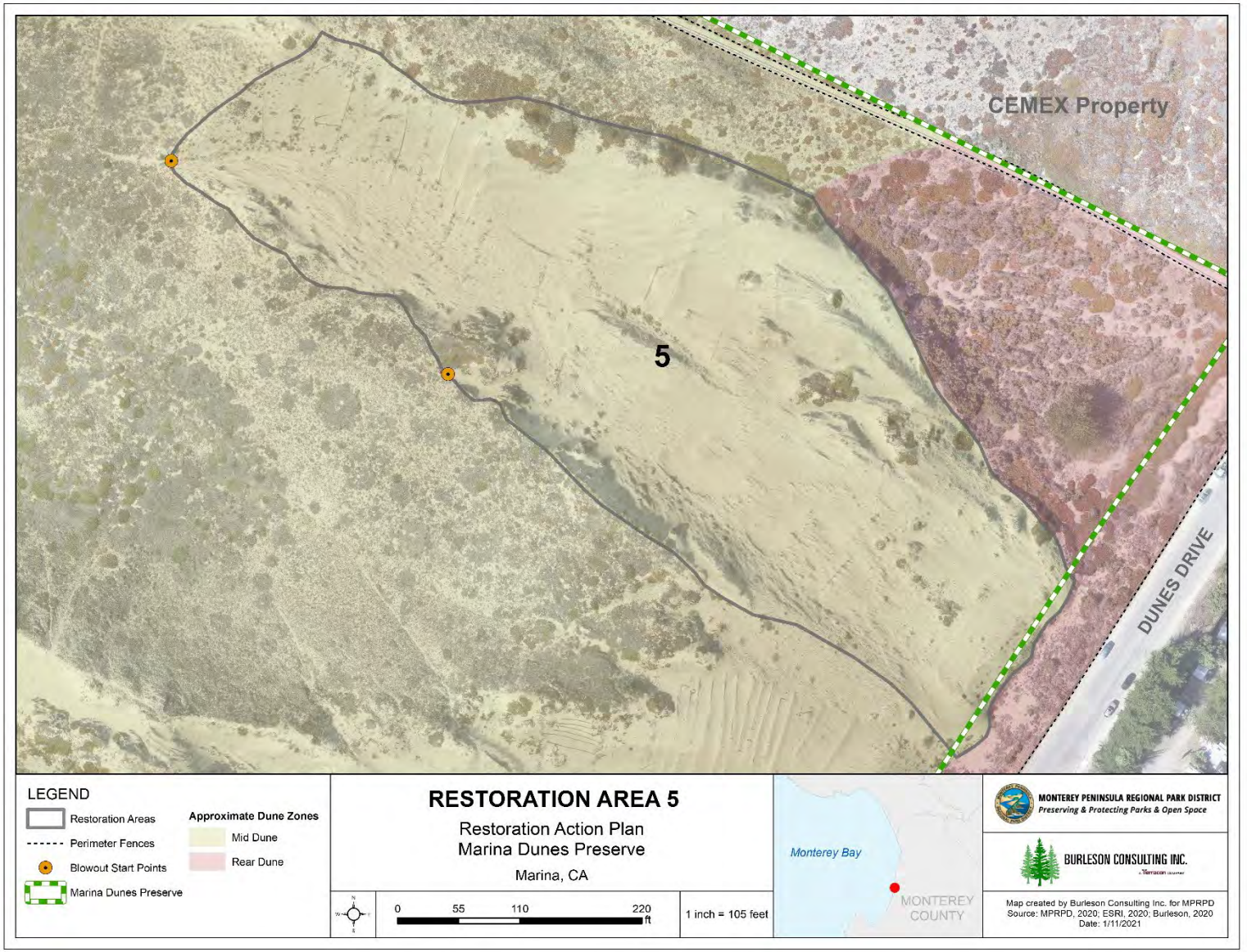

Figure C-6. Restoration Area 5.

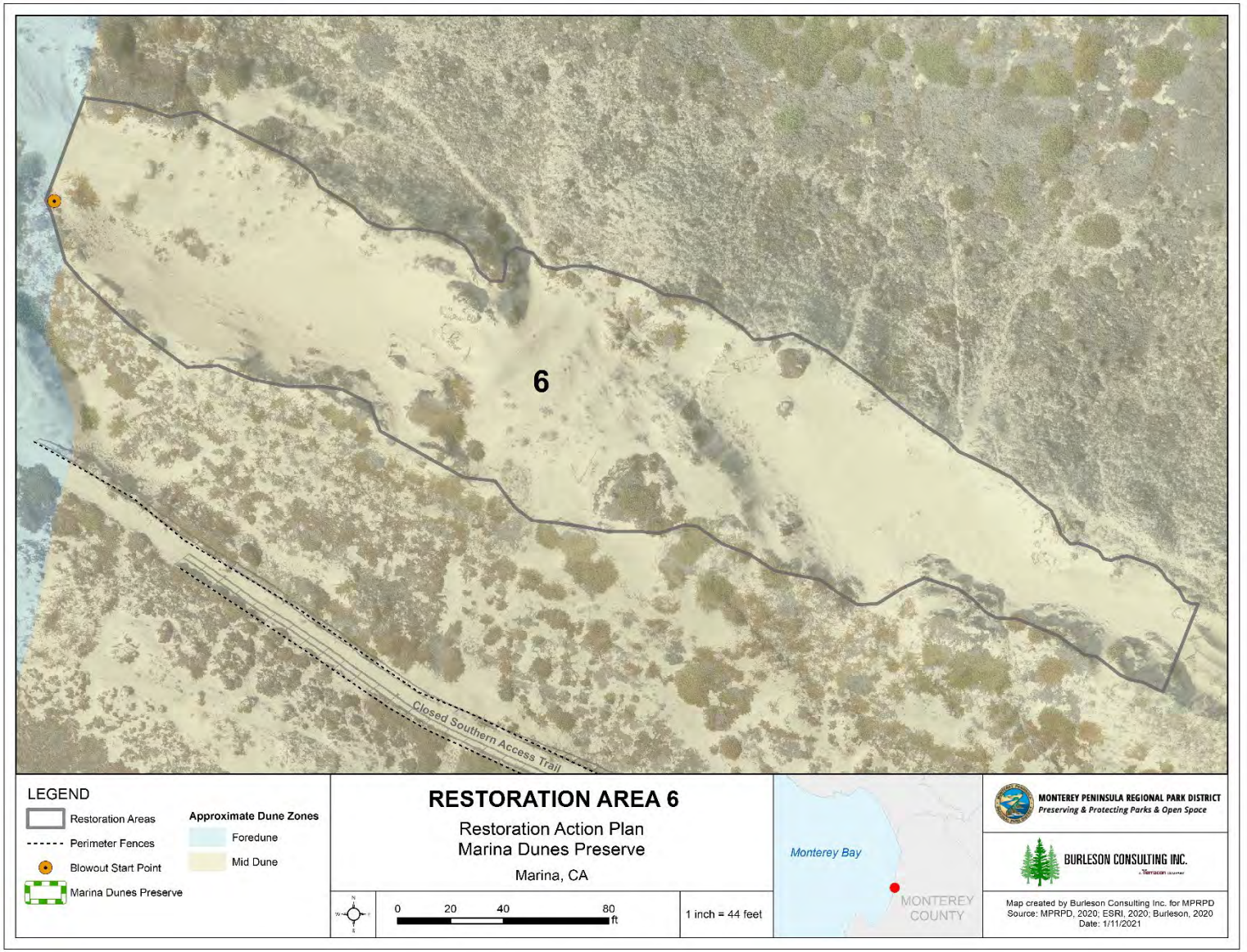

Figure C-7. Restoration Area 6.

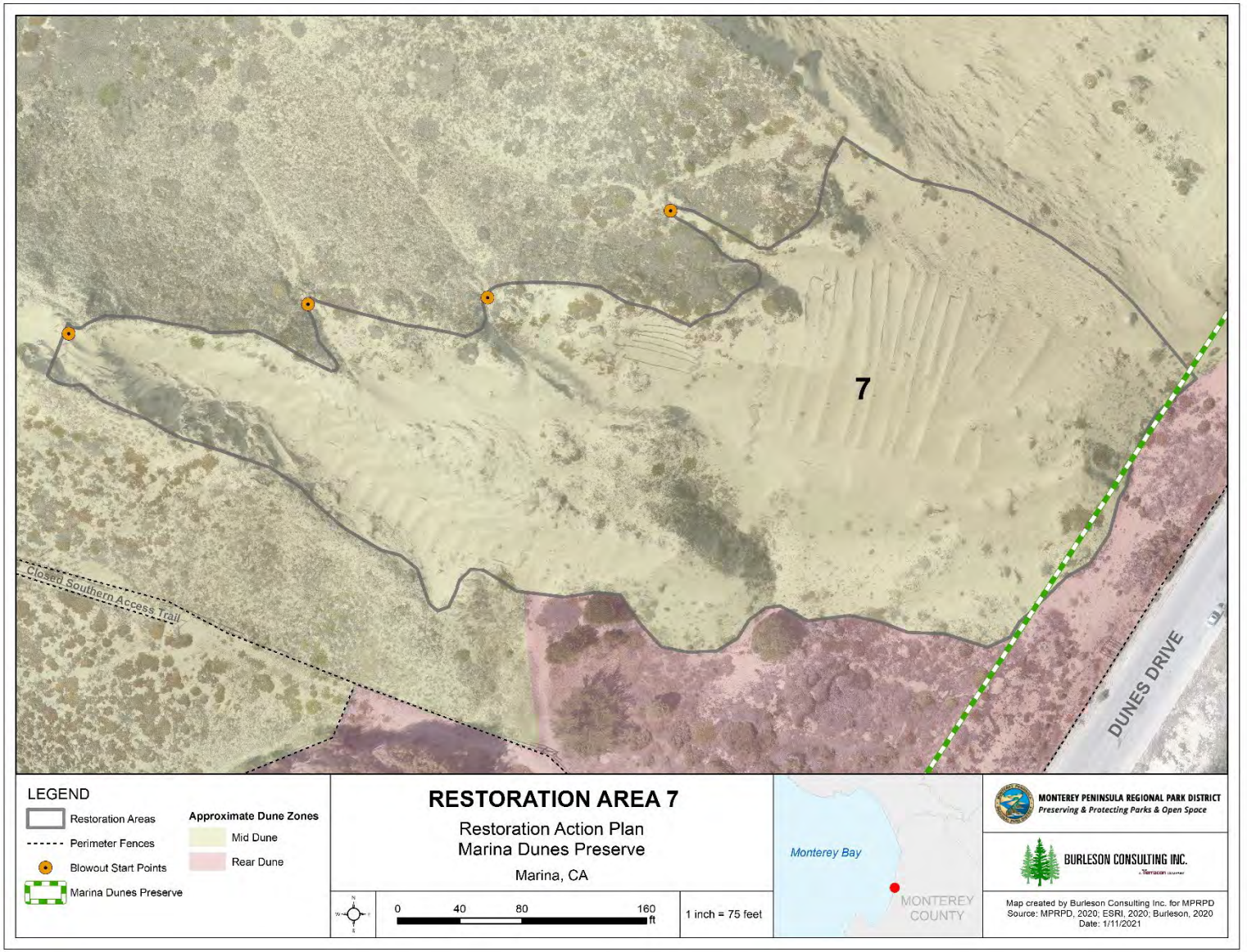

Figure C-8. Restoration Area 7.

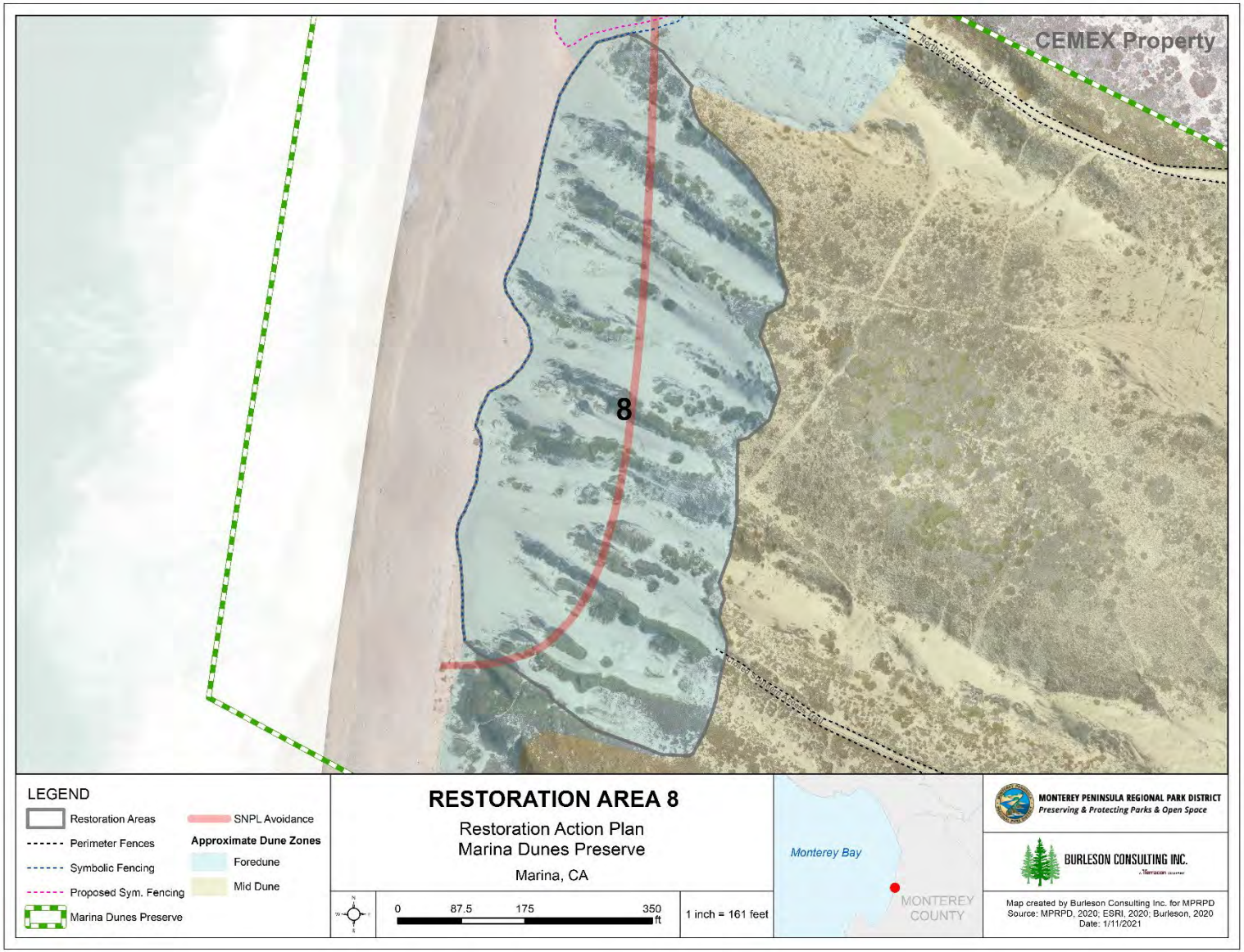

Figure C-9. Restoration Area 8.

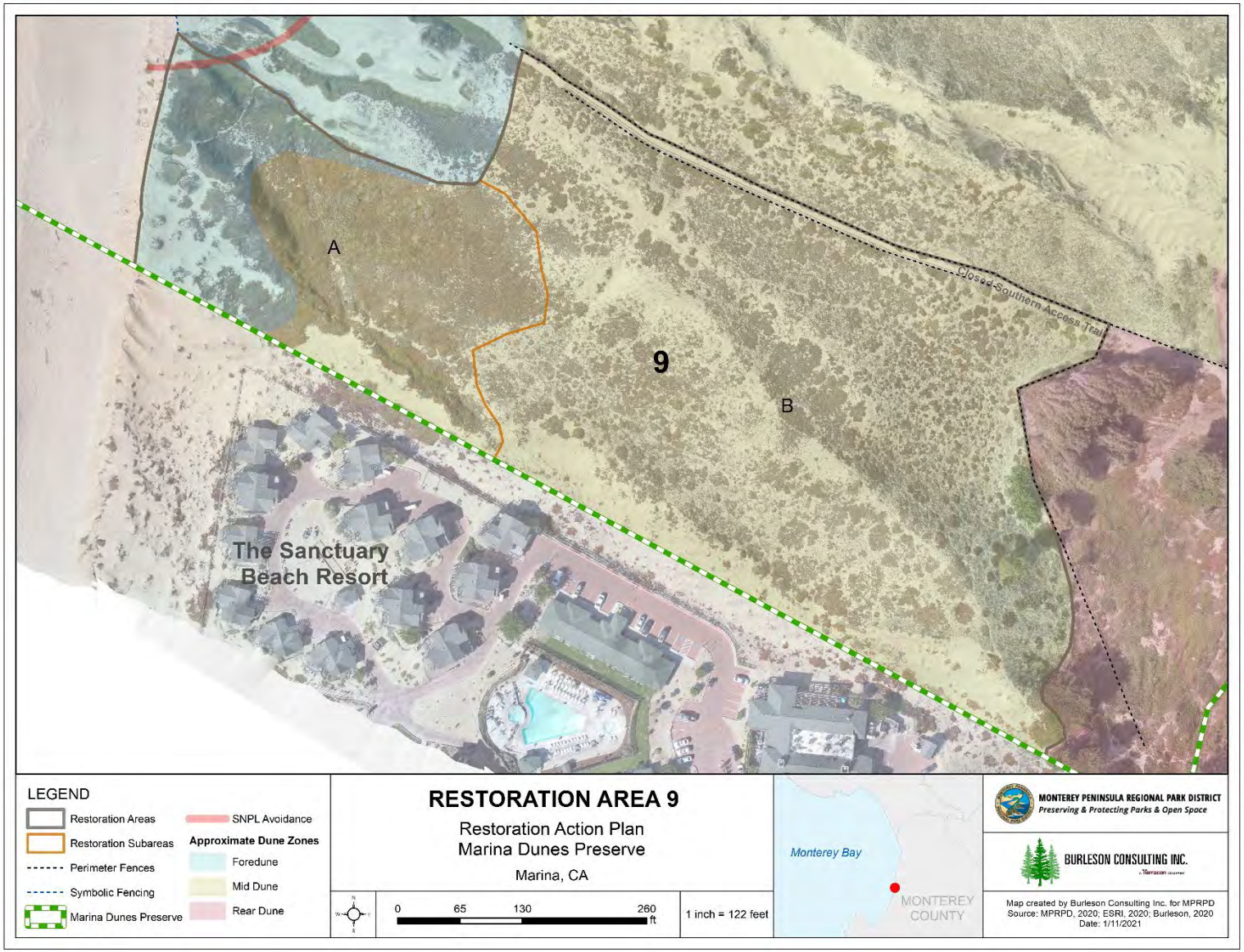

Figure C-10. Restoration Area 9.

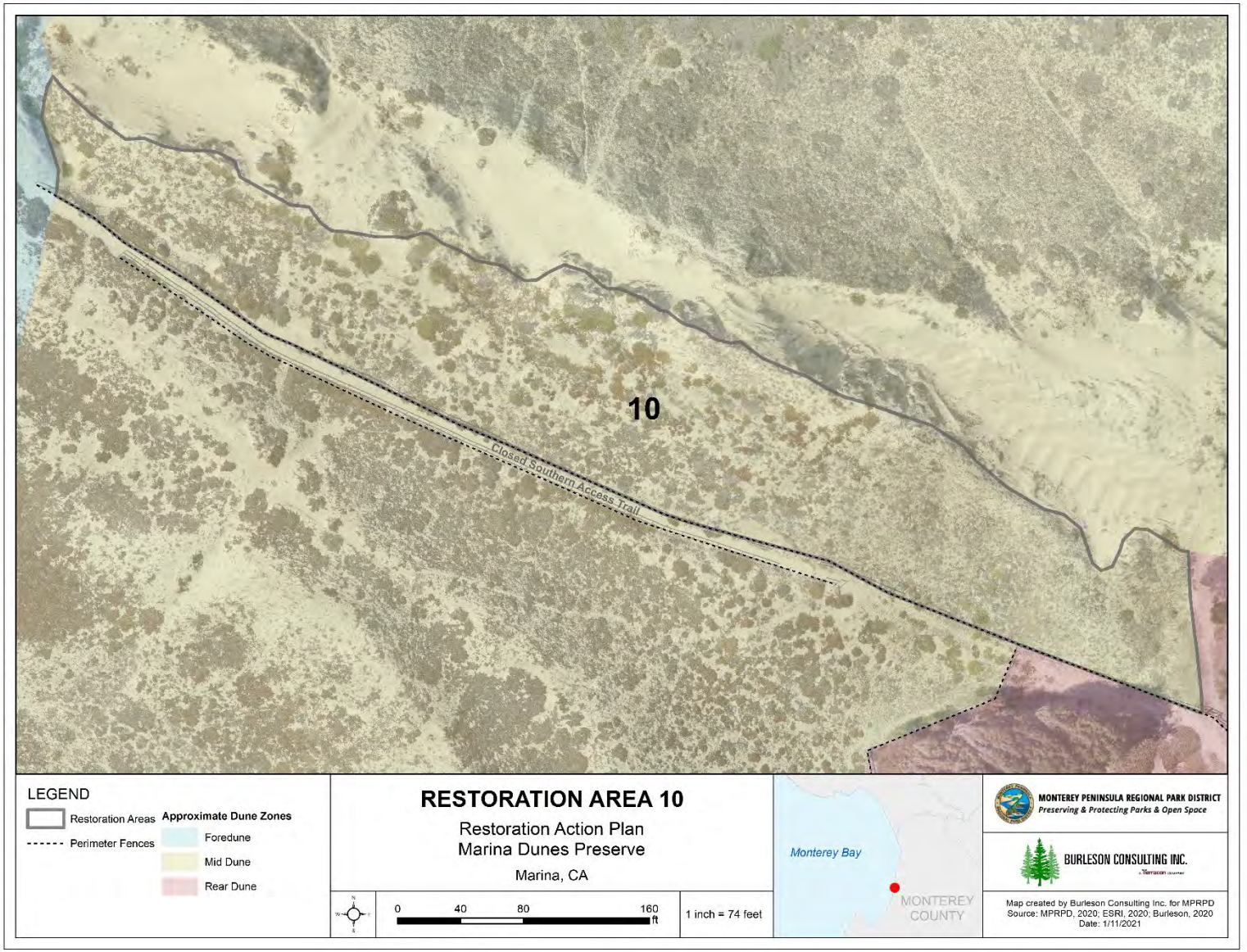

Figure C-11. Restoration Area 10.

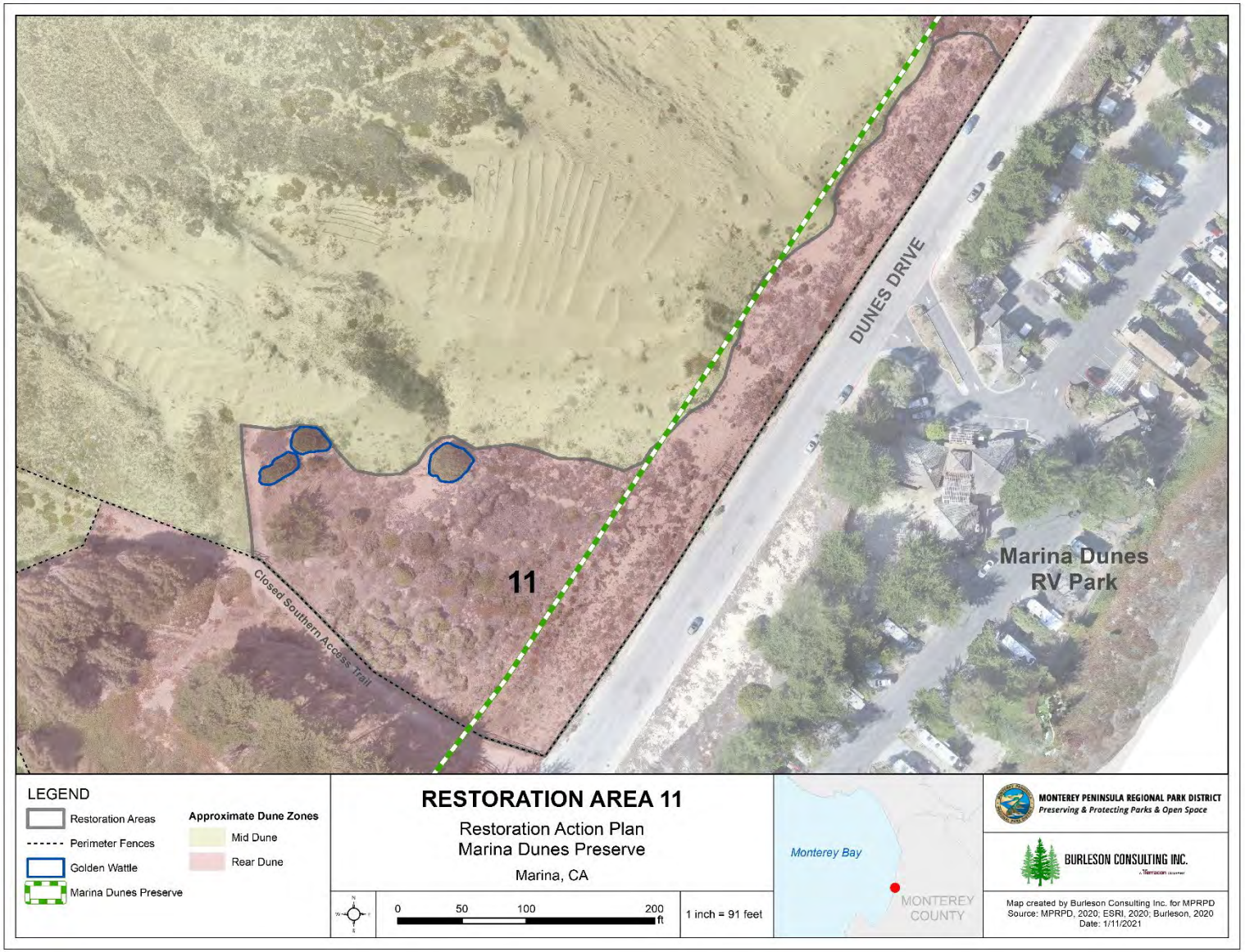

Figure C-12. Restoration Area 11.

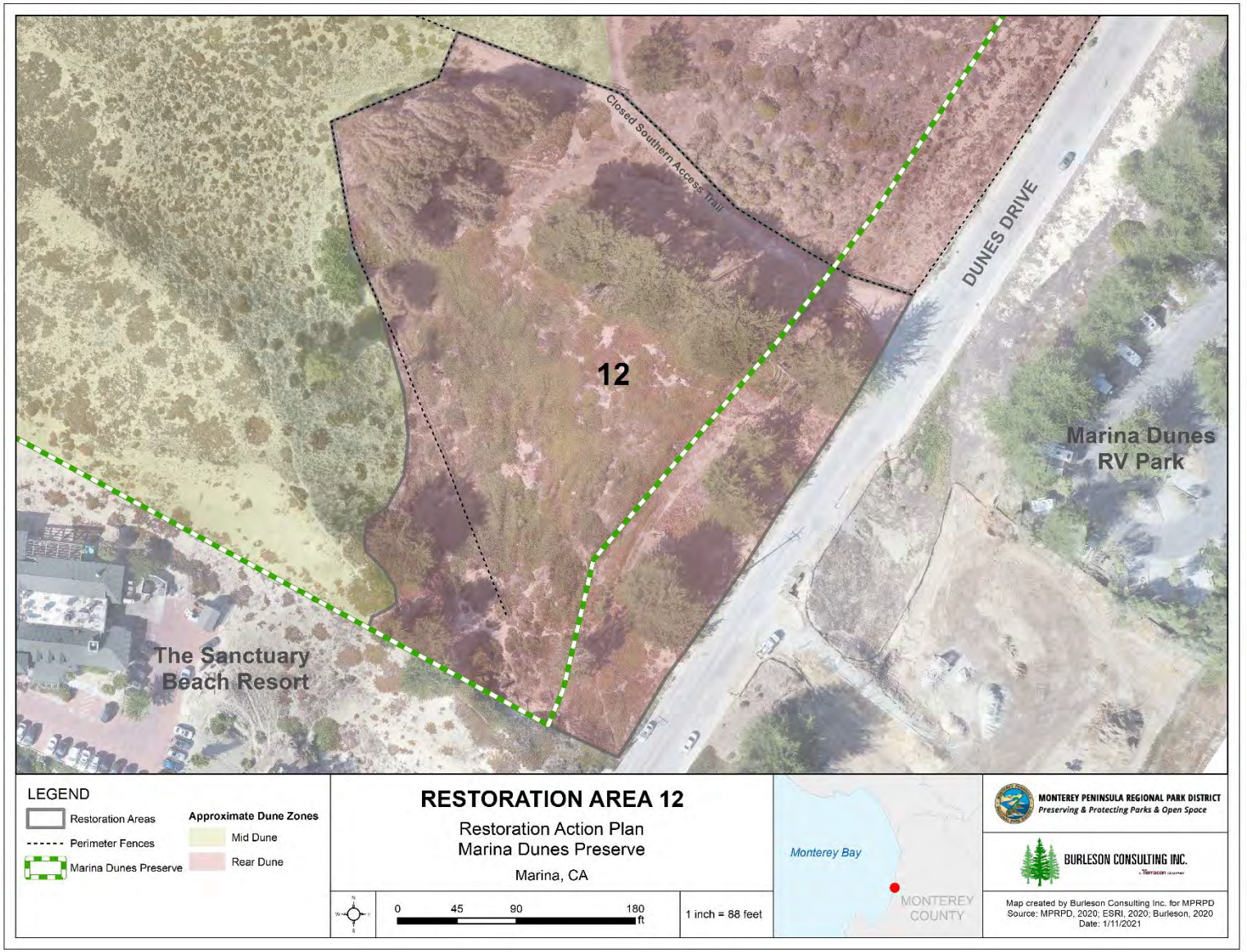

Figure C-13. Restoration Area 12.

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APPENDIX D

Photos of Current Signage

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Figure D-1. Trail Closure signs at entrance to southern access trail.

Figure D-2. Trail Closure signs at southern access trail gate.

Figure D-3. Tsunami Hazard Zone sign west of the southern access trail gate.

Figure D-4. Trail Closure signs and compromised fence west of sign in Figure C-3.

Figure D-5. Closed to Entry signs along Dunes Drive placed approximately every 30 – 50 feet.

Figure D-6. Public Access sign contradicting southern Trail Closure sign pictured in Figure C-1.

Figure D-7. Coastal Access sign at the start of the northern access trail at the end of Dunes Drive.

Figure D-8. Northern access trail kiosk along with information on western snowy plover and dog policies.

Figure D-9. Interpretive sign set back from northern access trail.

Figure D-10. Closed to Entry sign in front of unauthorized trail that leads to the center of the Preserve.

Figure D-11. Closed to Entry sign close-up along the northern access trail. Closed to Entry signs are placed along the southern fence line every 50 – 100 feet.

Figure D-12. Western snowy plover interpretive sign in Restoration Area 3.

Figure D-13. Western snowy plover interpretive sign in Restoration Area 3.

Figure D-14. Pets on leash sign along boundary between Restoration Areas 8 and 13.

Figure D-15. Area Closed for Plant Rehabilitation sign within Restoration Area 8.

APPENDIX E

Photos of Current Site Conditions

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Figure E-1. Restoration Area 1, Subarea A, looking east.

Figure E-2. Restoration Area 1, Subarea B, looking northwest from Subarea A.

Figure E-3. Restoration Area 2, Subareas A (in background) and B (in foreground), looking northeast.

Figure E-4. Restoration Area 3, looking southeast.

Figure E-5. Restoration Area 5, looking west. Note: no photo taken of RA 4.

Figure E-6. Restoration Area 6, looking southeast.

Figure E-7. Restoration Area 7 looking east.

Figure E-8. Restoration Area 8, looking north.

Figure E-9. Restoration Area 8, looking south.

Figure E-10. Restoration Area 9, Subarea A, looking southwest.

Figure E-11. Restoration Area 9, Subarea B, looking southeast.

Figure E-12. Restoration Area 10, looking southeast. Note: not all of site is pictured.

Figure E-13. Restoration Area 9, Subarea B, to the left of closed southern access trail and Restoration Area 10 to the right of the access trail, looking northwest.

Figure E-14. Restoration Area 11 looking west. Note: visible dunes are within RA 7.

Figure E-15. Restoration Area 12, looking north.

Figure E-16. Restoration Area 13 looking south.

APPENDIX F

Five-Year Restoration Schedule
& Budget

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EXHIBIT A: MARINA DUNES PRESERVE FIVE-YEAR RESTORATION BUDGET SUMMARY

Task	Description	Total Estimated Cost (labor + direct costs)															
		Yr 0 Q3	Yr 0 Q4	Yr 1 Q1	Yr 1 Q2	Yr 1 Q3	Yr 1 Q4	Yr 2 Q1	Yr 2 Q2	Yr 2 Q3	Yr 2 Q4	Yr 3 Q1	Yr 3 Q2	Yr 3 Q3	Yr 3 Q4	Yr 4 All	Yr 5 All
1	**Restoration Area 1**																
1.1	Subarea A weed eradication	$1,055				$3,339											
1.2	Subarea A planting					$20,000				$10,000							
1.3	Temporary interpretive signage					$198											
1.4	Subarea A success monitoring					$1,130					$1,071						
1.5	Land ownership for Subarea B																
1.6	Subarea B planning																
2	**Restoration Area 2**																
2.1	Subarea A planting	$30,000				$10,000											
2.2	Subarea A success monitoring	$1,305					$1,050								$1,092		
2.3	Smith's blue butterfly monitoring			$1,182				$1,180									
2.4	Subarea A weed eradication										$7,585				$3,441		
2.5	Subarea B weed eradication					$7,461					$2,865						
2.6	Subarea B planting									$20,000							
2.7	Subarea B success monitoring									$1,151					$1,067		
3	**Restoration Area 3**																
3.1	Sand stabilization	$1,725			$11,471				$1,082								
3.2	Rare plant surveys		$390				$397				$405						
3.3	Planting													$30,000			
3.4	Success monitoring													$1,172			
4	**Restoration Area 4**																
4.1	Weed eradication									$3,390				$3,441			
5	**Restoration Area 5**																
5.1	Sand stabilization			$9,293	$9,293			$4,541	$4,541				$1,284				
5.2	Planting																
5.3	Weed eradication																
6	**Restoration Area 6**																
6.1	Sand stabilization												$3,345	$3,345			
6.2	Planting																
6.3	Weed eradication																
7	**Restoration Area 7**																
7.1	Sand Stabilization												$7,339	$7,339			
7.2	Planting																
7.3	Weed eradication																
8	**Restoration Area 8**																
8.1	Weed eradication																
8.2	Planting																
8.3	Sand stabilization																
9	**Restoration Area 9**																
9.1	Smith's blue butterfly monitoring			$1,132				$1,155									
9.2	Rare plant survey Subarea B		$365				$372				$380						
10	**Land Stewardship**																
10.1	Ongoing land stewardship	$2,000	$2,000	$8,160	$8,160	$8,160	$8,160	$8,323	$8,323	$8,323	$8,323	$8,490	$8,490	$8,490	$8,490	$34,638	$35,331
		TOTAL	**$38,840**			**YEAR 1 TOTAL**	**$108,961**			**YEAR 2 TOTAL**	**$92,637**			**YEAR 3 TOTAL**	**$96,821**	**$34,638**	**$35,331**

Definitions
Year 0 = FY20-21
Year 1 = FY21-22
Year 2 = FY22-23
Year 3 = FY23-24
Year 4 = FY24-25
Year 5 = FY25-26

Q1= July, August, September
Q2= October, November, December
Q3= January, February, March

Created: 2/5/2021