

**BIOLOGICAL RESOURCES
OF THE DEL MONTE FOREST**

COASTAL DUNES

**DEL MONTE FOREST
PRESERVATION AND DEVELOPMENT PLAN**

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Biological Resources of the Del Monte Forest Coastal Dunes

1.0 INTRODUCTION

Zander Associates has prepared this report at the request of the Pebble Beach Company to evaluate the coastal dune resources within the Del Monte Forest Preservation and Development Plan (DMF Plan) project area. Coastal dunes within the DMF Plan area consist primarily of fragmented remnants of a once more extensive dune system that occurred along the Monterey Peninsula shoreline. Because they are limited in extent and area and support a diversity of sensitive species of plants and animals, coastal dune resources on the Monterey Peninsula are afforded special protections through the Monterey County Local Coastal Program (LCP) and the Del Monte Forest Land Use Plan (LUP).

The DMF Plan was developed with the intent of preserving and protecting sensitive biological resources within the Plan area in perpetuity while providing for reasonable and appropriate land uses consistent with the DMF LUP. In the case of coastal dune resources, DMF Plan has eliminated some of the land uses associated with previous development plans that could have compromised these resources. In addition, facilities have been sited and designed to avoid direct encroachment, to eliminate the existing indirect adverse effects associated with ongoing operations (e.g. in the Spyglass Pit area), and to maximize dune restoration and enhancement opportunities.

This report considers the existing conditions and project effects on both the remnant dunes and the designated rehabilitation area within the DMF Plan area. The report is based on previous documentation of the coastal dune resources in the Plan area developed through analysis of the formerly proposed Pebble Beach Lot Program supplemented by more recent, site-specific review conducted by Zander Associates. Coastal dune resources, with particular emphasis on the Signal Hill Dune area, were evaluated in the field during the spring and early summer of 2001. Large-scale (1" = 100') aerial photography and topographic maps were used to record baseline data. Vegetation types were identified and mapped, directed searches for special-status species were conducted in association with Mr. Vern Yadon, a noted local expert on Monterey County flora, and the previous boundary designation of environmentally sensitive habitat area (ESHA) was assessed. Current DMF Plan elements along with LUP designations for the area were then overlaid on this baseline biological resource information. Follow-up field checking occurred as necessary to complete the assessment.

The following sections of this report present an overview of coastal dune resources in the Plan area, evaluate their relationship to DMF Plan elements as proposed and provide a general program for dune conservation, enhancement and restoration.

2.0 OVERVIEW OF DUNES WITHIN THE DMF PLANNING AREA

2.1 Remnant Dunes

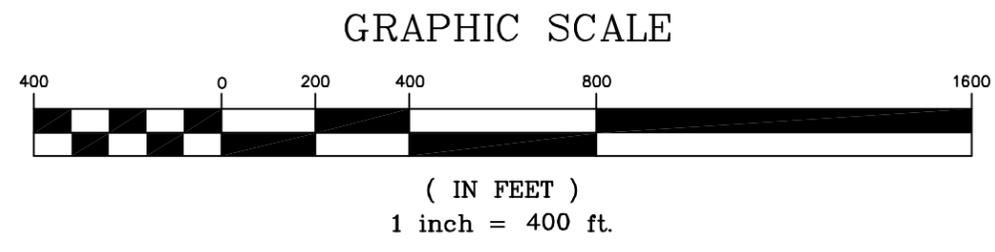
Remnants of native coastal sand dune habitat occur in two locations that are rezoned by the DMF (Measure A) Plan: adjacent to the proposed new golf course (Areas M & N) and at the westerly edge of Area L (at the entrance to Indian Village). Both of these sites are located within the Spyglass Cypress planning area of the DMF LUP and are mapped therein as environmentally sensitive habitat areas (ESHAs—see Figure 1). These areas are remnants of a once extensive natural sand dune system that has been fragmented by sand mining, the construction of roads, including the 17-Mile Drive, golf courses, and other urban and recreational development and land uses over the years.

These formerly extensive dune systems occupied a transitional ecological niche between shoreline and coastal strand environments and the forested habitats of the Monterey Peninsula. They once supported only native coastal strand and coastal scrub vegetation characterized by species such as beach sagewort (*Artemisia pycnocephala*), lizard tail (*Eriophyllum staechadifolium*), buckwheat (*Eriogonum parvifolium*), beach aster (*Lessingia filaginifolia*), live forever (*Dudleya caespitosa*), mock heather (*Ericameria ericoides*) and purple bush lupine (*Lupinus chamissonis*) merging into windswept Monterey pine forest, which stabilized the back-dunes at their easterly edges. Today, only small patches of native dune habitat remain, often invaded by non-native species such as ice plant (*Carpobrotus edulis* & *C. chilense*), French broom (*Genista monspessulana*), acacia (*Acacia longifolia* and *A. verticillata*) and pampas grass (*Cortaderia jubata*). Consequently, some of the plants [e.g. Monterey spineflower (*Chorizanthe pungens* var. *pungens*), Menzies' wallflower (*Erysimum menziesii*), beach layia (*Layia carnosa*), sand gilia (*Gilia tenuiflora* var. *arenaria*), Tidestrom's lupine (*Lupinus tidestromii* var. *tidestromii*)] and animals [e.g. Smith's blue butterfly (*Euphilotes enoptes smithi*), black legless lizard (*Anniella pulchra nigra*), coast horned lizard (*Phrynosoma coronatum frontale*), western snowy plover (*Charadrius alexandrinus nivosus*)] typically associated with dune habitats have become increasingly uncommon, in some cases resulting in their listing as rare, threatened or endangered by state and federal resource agencies.

The Signal Hill remnant dune, located between the Spyglass Pit (Area M) and the Cypress Point Golf Course is a relatively large area of more or less intact dune substrates stabilized by Monterey pine and coastal scrub vegetation on its upper slopes (Photos 1 & 2). Much of the area has been invaded by iceplant, especially as understory to the pines and in areas of disturbed, shifting sand along the exposed flanks of the hill (Photos 3 & 4). However, viable areas of coastal dune vegetation and sandy openings occur in the Signal Hill Dune area providing habitat for five special-status plant species: Monterey spineflower, Menzies' wallflower, beach layia, Tidestrom's lupine and sand gilia (Photos 5 & 6). This remnant sand dune also provides potential suitable habitat for the black legless lizard, which inhabits sand dunes and areas of loose, friable soils on the Monterey Peninsula and is known from the dunes around Spanish Bay.



FIGURE 1. REMNANT DUNES
 SPYGLASS CYPRESS PLANNING AREA
 DEL MONTE FOREST LAND USE PLAN



I:\Pebble Beach Golf Course\ZANDER_FIG1.dwg -00SCALE. 06/04/2004 10:58:00 AM. Jeff. PDF-XChange 3.0.pc3. Tablot6/ANSI B. 1:0.974763

Area Golf Course
 Surveyed 3/28/01
 P. Polatin and the Pebble Beach Facility Corp.

The Indian Village remnant dune, located south of Seal Rock Creek and east of Seventeen Mile Drive (Figure 1) is not as large or topographically varied as Signal Hill but has been restored and regularly managed by the Pebble Beach Company as a dune restoration area (Photo 7). The site supports a good mix of coastal dune and scrub vegetation and is a known location for special-status species such as beach layia and Menzies' wallflower (Photo 8). A small finger of this dune complex, located across Dunes Road at the westerly tip of Area L, was not identified as ESHA in the DMF LUP. While isolated, this small dune fragment, backed against Monterey pine forest, appears relatively stable with good depth of sand vegetated by limited dune species along with large iceplant mats.

2.2 Rehabilitation Area

In addition to remnant native sand dune habitat, the DMF LUP also recognizes former sand dune areas that have been mined and are in need of rehabilitation. The LUP identifies such areas as the most suitable for more intensive development compared with other forested and undeveloped lands in the DMF. Encouraging more intensive use of these areas is also intended to provide incentive for rehabilitation and restoration of other degraded habitats.

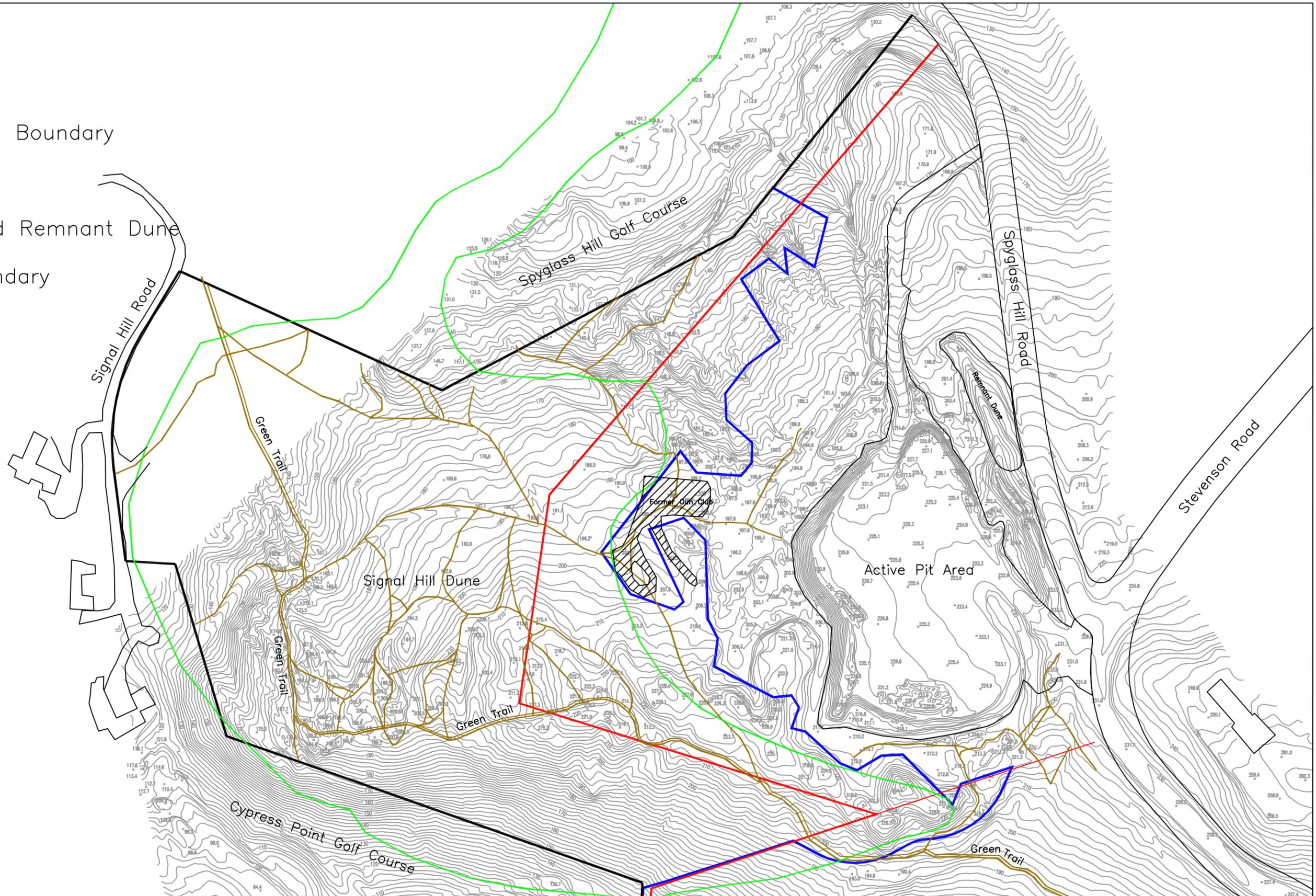
The former sand mining location referred to as the Spyglass Pit (Area M—Figure 2) is identified as a rehabilitation area and was zoned and planned for relatively high density (4du/acre) residential development in the DMF LUP. Much of the dune habitat that once occurred in this area, including most of the sandy dune substrate itself, was removed in the course of sand mining. In addition, the site was used as an equestrian center and a skeet shooting range in the past and more recently as an equipment and materials staging and storage area.

The most prominent feature on the site today is the active pit area, an approximately six-acre flat plateau now used to store fill and other material and equipment (Figure 2). The active pit area is virtually devoid of vegetation but the slopes of the fill have been colonized by a wide range of ruderal (weedy) and invasive plant species such as ripgut brome, French broom, hemlock (*Conium maculatum*), kikuyu grass (*Pennisetum clandestinum*) and iceplant. Adjacent to the western and southern edges of the pit slope are areas of degraded dune substrates ranging from almost barren mineral soils and scraped sands to remnant mined dunes with varying depths of sand. Except for aggressive native colonizers like Monterey pine and bush lupine, the more disturbed areas are largely vegetated by non-native grasses and species like iceplant, pampas grass, and acacia (Photos 9-12).

Portions of the areas surrounding the active pit have enough remaining sand to support a predominance of coastal strand and dune vegetation (Photo 13). Occurrences of special-status species like Tidestrom's lupine, sand gilia, Monterey spineflower and beach layia have been recorded from the less-disturbed sandy substrates in these areas. However, non-native invasive species that have colonized adjacent disturbed ground pose a constant competitive threat to these habitat fragments. Iceplant, in particular, is common on the sandier areas and dominates

LEGEND

- Trails
- Former Area M Boundary
- ESHA Boundary
- LUP Designated Remnant Dune
- DMF Plan Boundary



Scale: 1" = 200'

sizable patches of both disturbed and natural substrates (Photos 11 & 12). An area of open, relatively deeper sand to the northwest of the active pit area also contains a cover of clay shards which are the remnants of targets used by the gun club that formerly occupied an area to the west of the pit (Photo 14 & Figure 2).

Monterey pine forest, some of it on dune sands, becomes the dominant vegetation type in areas beyond the influence of disturbance associated with Spyglass Pit. However, the main grove of Monterey pines on dune substrates occurs to the west, primarily on the upper slopes of the Signal Hill Dune (see discussion above).

2.3 ESHA Boundary

Under the analysis conducted for the Lot Program EIR, the dune habitats and substrates in the vicinity of Spyglass Pit were assessed to define a more accurate, resource-based remnant dune ESHA boundary than the general, plan-line boundary provided in the LUP (see Figure 2). Dune ESHA was determined to occur where the entire substratum was clearly transported and deposited by wind, and where the physical landform was stabilized by Monterey pine or other native vegetation, notwithstanding the presence of some non-native vegetation. Best professional judgement was applied in the field to determine whether unequivocal dune areas substantially overrun by iceplant constituted ESHA. Areas of sand substrate that was deposited as fill material, whether the thin surface is mobilized by wind or not, were not determined to be ESHA. Areas where the dune substratum had been mined and not replaced by continuing wind-deposited sand were also not determined to be ESHA.¹

The remnant dune ESHA boundary was evaluated and staked by a consulting biologist in 1995 and surveyed into the site maps by the project civil engineers. The boundary was subsequently reviewed on the ground in the company of representatives from the Monterey County Planning and Building Inspection Department, staff of the Santa Cruz office of the California Coastal Commission and the Pebble Beach Company in May 1996.

A recent evaluation was conducted to update the previous information and confirm that the site-specific ESHA boundary remained appropriate for the purposes of the DMF Plan (See Appendix A). Vegetation was typed and mapped over the entire Signal Hill Dune and Spyglass Pit Area. In addition, the location of special-status plant species was checked. A clear relationship between vegetation/soil types (e.g. ruderal, ruderal colonizing, iceplant, disturbed sand vs. open sand, dune, scrub), special-status species and the ESHA boundary was identified through the application of this method (Figure 3). Based on this evaluation, we conclude that the site-specific determination in the previous analysis appropriately establishes the ESHA boundary in the Spyglass Pit area. For the purposes of the DMF Plan, the small

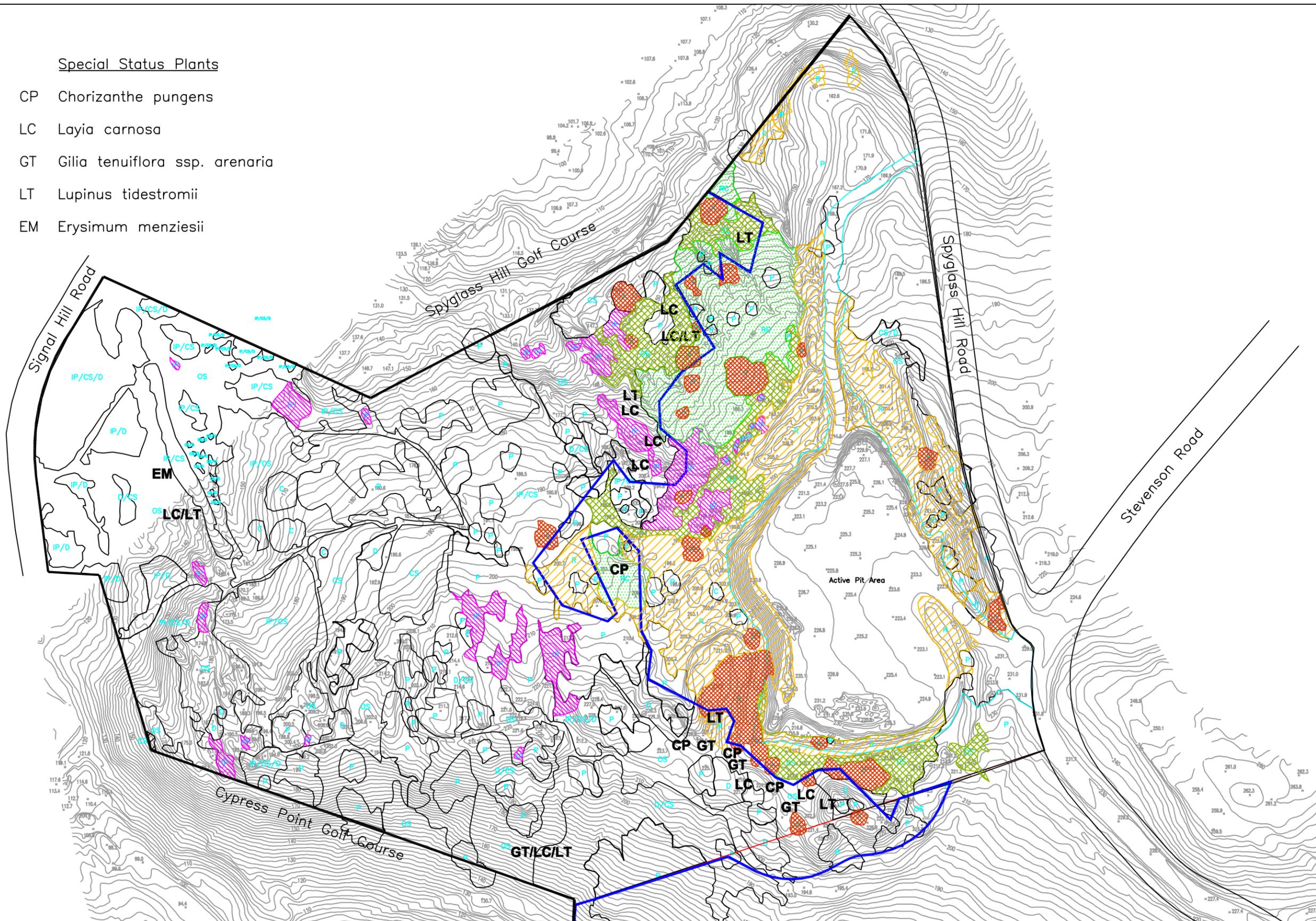
¹ A small (0.6 acre) remnant dune area on more or less undisturbed sandy substrates and containing some native vegetation was also identified within the Area M rehabilitation area along its easterly boundary paralleling Spyglass Hill Road (see Figure). While this small area would technically qualify as dune habitat ESHA under the LUP definition, the previous analysis determined it to be part of the Area M rehabilitation area because of reduced biological value due to its small size and isolation.

LEGEND

-  Acacia (A)
-  Disturbed Sand (DS)
-  Iceplant (IP)
-  Ruderal (R)
-  Ruderal/Colonizing (RC)
- C Cypress
- CS Coastal Dune Scrub
- D Dune Vegetation
- OS Open Sand
- P Pine
-  ESHA Boundary

Special Status Plants

- CP *Chorizanthe pungens*
- LC *Layia carnosa*
- GT *Gilia tenuiflora* ssp. *arenaria*
- LT *Lupinus tidestromii*
- EM *Erysimum menziesii*



Scale: 1" = 200'

remnant dune area along the easterly boundary of the active pit paralleling Spyglass Hill Road is also included as ESHA.

3.0 RELATIONSHIP TO THE DMF PLAN

3.1 Preserve Areas (Area L and Signal Hill Dune)

No development will occur in Area L as part of the DMF Plan. Indirect effects associated with improved access through the dune area and proximity of new residential uses that would have occurred with the previous project will be eliminated by the present plan. The remnant native dune in this area will be conserved as permanent open space in perpetuity and enhanced in conformance with the dune conservation, enhancement and restoration program component of the DMF Plan (see below). These enhancement activities will complement existing dune enhancement and restoration work previously completed by the Pebble Beach Company in the adjacent dune areas to the west.

The Signal Hill Dune, although already designated as an open space preserve area through the DMF LUP, is formally included as a component of the DMF Plan. While the previous (Lot Program) development proposal only considered lands within the Area M boundary as part of the project, the DMF Plan has extended the project boundary to include all of Signal Hill (Figure 2), resulting in an additional ± 25 acres of restorable sand dune habitat. Consequently, the Signal Hill Dune area will be enhanced as part of the DMF Plan in conformance with the plan's dune conservation, enhancement and restoration program (see below).

3.2 Development Areas (New Golf Course and Facilities—Areas M & N)

3.2.1 General Design Considerations

As with the previous (RA2) golf course development proposal, the current course has been configured to avoid direct impact in areas of remnant dune habitat as identified by the site-specific evaluation discussed above. However, unlike the previous plan, the golf cottages (previously proposed as condominiums) have been relocated to also avoid direct encroachment on the small isolated dune that parallels Spyglass Hill Road. The course and associated facilities through Areas M and N have been designed for compatibility with the dune environment and to provide added enhancement opportunity through the creation of new dune landforms supporting dune vegetation in the context of golf. Tee boxes will be located on previously disturbed ground, fairways will be designed with a links-type configuration to minimize disturbance and increase restoration opportunities, remnant/restored dunes will be out of bounds and protected (e.g. by a fence too high to be easily stepped over), and all golf-related and recreational (e.g. hikers, walkers, equestrians) access and egress into and through

the area will be directed by formalized (e.g. boardwalks) cart/pedestrian paths, barriers (e.g. fences) and signage. This latter design element will facilitate restoration of several other unplanned, degrading footpaths that now exist through the Signal Hill Dune area (See Figure 2).

A major design feature of the new course in the area will be the creation and establishment of new dune landforms within the golf course footprint (Figure 4). Sandy soils will be contoured to emulate natural dune forms between tees, fairways and greens. Vegetation on these new dune forms (outside of turfed areas for golf play) will be restricted to only those plants compatible with the native dune environment. However, no formally-designated restoration areas will be located within the perimeter of the golf course. Dune environments created or restored within the perimeter will be regarded and managed as landscape features but will also provide opportunity for the natural establishment of native dune vegetation and eliminate sources of non-native weedy species into the adjacent dunes.

3.2.2 Golf Course Specific Design

Golf holes 15, 16 and 17 will all be located within the Area M rehabilitation area on previously disturbed dune substrates or within the footprint of the active pit itself (Figure 4). Tee boxes for hole 15 will be elevated by creating sand mounds above the existing grade of a disturbed area adjacent to remnant dunes. These mounds will be vegetated with appropriate dune species creating a natural transition between the adjacent dune and the 15th tees and eliminating the current source of invasive weeds in this area. Access to the 15th tee boxes from the south will be by way of a boardwalk through the dune area (Figure 4). The 15th green will be developed as a limited (turfed) landing area in the context of additional created dune landforms. Golf hole 16 will be similarly designed (e.g. limited, links-type tees and landing areas) with tee boxes located within the footprint of the former skeet shooting range and a defined landing area constructed to the east of the dune ESHA boundary. Again, construction of this landing area will replace disturbed substrates and non-native species with a golf green surrounded by created dune forms. Finally, the tees for the 17th hole will mostly follow the alignment of the existing northerly access road into the Spyglass Pit area with turfed fairways and greens constructed within the footprint of the active pit area. Access to all tees, fairways and greens will be directed by boardwalks and paths through the created dune environment.

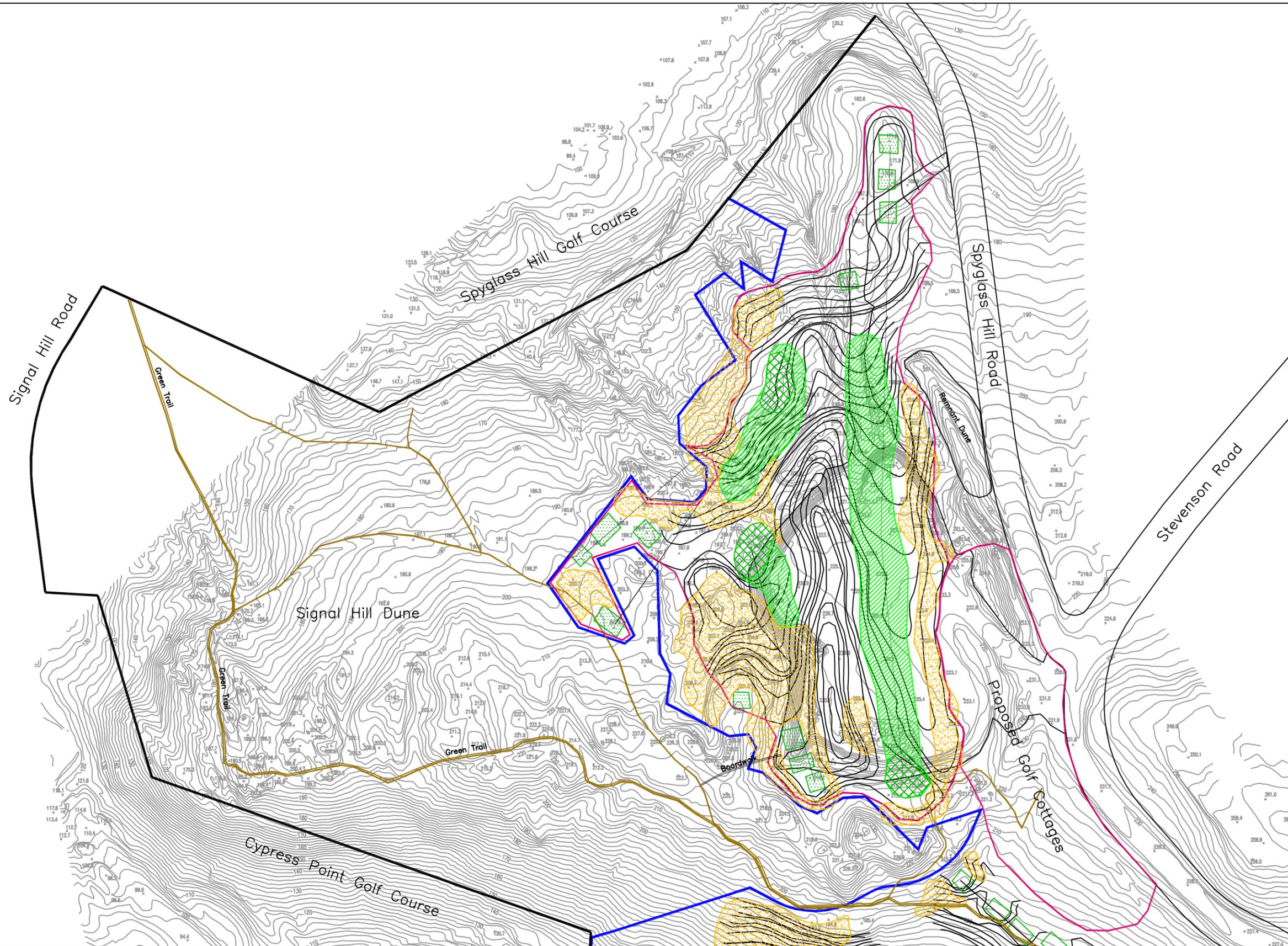
The 18th tee will also occur near the ESHA boundary to the south. However, the tee boxes will be located downslope of the dune boundary and golf play off of the 18th tee will be directed away to the south from the Signal Hill ESHA.

3.2.3 Golf Cottages

Golf Cottages instead of the previously proposed condominiums will abut the course, but they will be located more southerly along the 17th fairway with access and parking off of

LEGEND

-  Limit of Grading
-  New Dune Landforms
-  Tee
-  Green
-  Fairway
-  ESHA Boundary
-  DMF Plan Boundary



Scale: 1" = 200'

Stevenson Drive rather than the more northerly location along Spyglass Hill Road. This design modification means that the small (0.6 acre), relatively intact remnant dune along Spyglass Hill Road will not need to be relocated as in the previous proposal.

3.2.4 Assessment

Some limited temporary impacts on degraded dune habitat will result from construction of the new course and associated facilities. Approximately five acres of formerly mined, disturbed sandy substrates supporting a mix of ruderal and native colonizing vegetation along with approximately ten acres of active pit and associated ruderal disturbed slopes will be removed (See Appendix A). However, no grading or other ground-disturbing activity or encroachment beyond the designated ESHA boundary will occur as a result of construction of the new golf course or associated facilities in the Spyglass Pit/Area M area. In addition, no special-status species will be displaced. Construction fencing will be installed around the perimeter of the work area and a full time environmental monitor will be on site for the duration of construction. With implementation of these measures, construction activities should not cause any significant disruption to remnant dune habitats or special-status species.

In some cases, tees, greens and fairways will be setback less than 100 feet from remnant and restored dune areas. However, as noted above, the design parameters of the golf course have been established for compatibility with the dune environment. Tee boxes have been designed with reduced footprints and the extent of turfed fairways and greens is limited by the links design. The matrix of created dune landforms and native landscaping will provide additional habitat enhancement opportunity adjacent to the designated restored areas. Through elimination of iceplant, acacia, non-native grasses and other exotic species, there will actually be a substantial reduction in the threat of competition from invasive plants as a result of golf course design. Access in and through the area will be controlled along designated trails and boardwalks.

Use of the area will enable a considered dune conservation, enhancement and restoration program that will benefit dune habitat and dune species in adjacent areas. This program is detailed in the following section

4.0 DUNE CONSERVATION, ENHANCEMENT AND RESTORATION

4.1 Overview and Objectives

Dune habitat restoration and enhancement will be implemented in the remnant Signal Hill Dune area concurrent with golf course construction. In addition, creation of new dune landforms and landscapes will occur within the footprint of the golf course itself. The objectives of the dune restoration program are to establish permanently protected and

managed dune habitats and increase habitat values by eliminating invasive exotic plants, revegetating as appropriate with native plant materials, directing access, creating compatible adjacent environments and managing adjacent uses.

Dune restoration and enhancement efforts and dune landform creation will follow several proven principles:

- Removal of invasive non-native species and replacement by appropriate native species can result in effective restoration of dune habitat where appropriate substrate persists, but native vegetation is being overtaken by non-natives, degraded or absent.
- Coastal dune and scrub habitat can be established if sandy soils meeting certain physical and chemical criteria are available and are applied in sufficient quantity.
- Native dune vegetation, including sensitive plant species, can be established and maintained in restored or created dune habitats or dune-like landscapes, if and only if pedestrian or other traffic through the dunes themselves can be stringently controlled or virtually eliminated.
- Sensitive dune habitat can be effectively protected by aesthetically acceptable barriers and useful boardwalks (leading conveniently to the users' destination) where the nature of golf play and flow of pedestrians does not impinge upon the area; effective protection is not feasible, by any means yet applied, in a situation where the common flight of errant golf balls terminates in, or the logical flow of golfers from one site to another crosses, the area in question.
- Control of invasive non-native species is best achieved by maintenance or placement of sufficiently uniform-textured, organically sterile sand, rather than by weeding. Careful management of irrigation (overspray) and of surface or subsurface drainage of nutrient-enriched water are also important.

4.2 Non-Native Species Eradication

The primary invasive species on the majority of the remnant sandy substrates of the Signal Hill Dune area is iceplant. It aggressively colonizes exposed, disturbed or otherwise available spaces and forms dense mats over large expanses of sandy area, outcompeting natives for light, moisture and space. It comprises almost 100% of the understory of many areas of the Monterey pine on stabilized dunes at the crest and upper slopes of Signal Hill (see Photo 3). Another species that poses a threat to the dune sands is European beach grass (*Ammophila arenaria*), particularly at the interface between the south-facing slope of the Signal Hill Dune and the Cypress Point Golf Course. Originally introduced (and still actively used) for stabilization of sandy slopes, this species is now recognized as an invasive species that spreads by runners and seed into native dunes. Other non-natives such as rigput brome, acacia, French broom and pampas grass can also be found in the sandy areas, but these

species are far more abundant in the disturbed sand, ruderal and ruderal/colonizing areas associated with the Spyglass Pit area (see Figure 3).

Eradication and control of these non-native species will be accomplished by a combination of chemical and mechanical means. Chemical removal is best done with a glyphosate-based herbicide such as Roundup. Broadcast spraying may be acceptable in areas where the target species produce almost the entire vegetative cover, where special measures are not needed to protect native plants and where the risk of native plant loss due to drift of spray into non-target areas is minimal. Where native plants occur at a high enough density in treatment areas, spot spraying or manual removal (hand-weeding) will be necessary. The dead plants and debris may be left in place as mulch and wind protection, or may be removed by hand to minimize the source of nutrients for non-native species. The determination of removal or non-removal of organic debris will be made on the basis of the target vegetative cover and monitoring.

4.3 Dune Stabilization

Most of the Signal Hill Dune area consists of natural sandy substrates stabilized by some vegetation whether it be native dune species, iceplant mats or a combination (see Plate 1). The dune crest and upper slopes support a relatively high percent of plant cover, consisting primarily of Monterey pine and coastal dune scrub vegetation along with iceplant. The flanks of the dune have been colonized by coastal strand as well as coastal dune species and iceplant. More exposed windward slopes (i.e. northwesterly-facing) and disturbed or blowout areas have a higher percent of open sand. While some open sand areas are essential to maintaining the diversity of available habitats, and especially habitat for most of the special-status species associated with the dunes, these open areas need to be kept relatively stable as part of the long-term restoration and preservation objectives of Signal Hill. As non-native species are removed and replaced with natives, interim stabilization measures need to be considered; iceplant and European beach grass, though objectionable in the context of native dune restoration, do contribute to the stability of the dune sands. Blowouts and disturbed areas (e.g. eroded trails) need particular attention. Likewise, as new sandy substrates are placed in graded or otherwise disturbed areas to create new dune landforms, active stabilization measures will be required.

To stabilize the dunes and prevent large-scale movement of sand by prevailing onshore winds, various methods of temporary or permanent protection may be necessary, depending on existing vegetative cover, exposure, management area and management objectives. These measures may include (but are not necessarily limited to) crimped or plugged rice straw, snow fences, jute netting, temporary overhead irrigation and vegetative windbreaks composed of appropriate native strand or dune scrub species. Application of these dune stabilization measures will vary with the particular management area (see discussion below); areas of newly created dune landforms and areas of large-scale non-native species eradication will need more protection than already existing relatively stabilized areas. Vegetative breaks may need to be planted one or more years prior to removal of iceplant, European beach grass or

other stabilizing non-native vegetation. Straw crimping or installation of snow fencing can have more rapid results in areas of shifting sands. More aggressive techniques such as jute netting, hydroseeding with nurse crops and/or overhead irrigation could be necessary where new dune landforms are created as design elements of the golf course (see below).

4.4 Dune Creation

In areas where dune landforms will be created in the context of golf, the creation site will be initially cleared and graded to create final (subsurface) contours. Much of the on-site material in the Spyglass Pit area consists of unconsolidated fill material from various sources; this material is largely unsuitable for dune creation. However, some native and stockpiled sand can be found in the area (also possibly through overexcavation) and will be sorted, salvaged and stockpiled as part of the grading activity. In limited cases (e.g. beyond the golf course grading line in previously mined areas), dune habitat will be reestablished where dune sand substrates are presently substantially absent. These areas will not be graded as part of the golf course, but rather will be prepared by removal of existing vegetation and topsoil (O, A, and/or B horizon, if present).

As suitable sandy soils are identified through golf course grading, they will be stockpiled and eventually used as dune form creation material. All created dune forms will contain a significant (+50%) sandy fraction in the upper surface layers (two to three feet).

Created dune areas will require more aggressive stabilization and revegetation techniques than dune restoration areas on existing sandy substrates. Irrigation to keep the created dune landforms moist (wet sandy soils weigh more per particle and per unit volume than dry sand and are less likely to be transported by wind) and hydromulching with a mixture of native and non-native (nurse) crops will be necessary in the initial stages. The use of jute netting, erosion blankets, straw crimping or other active stabilization techniques may also be necessary and will be determined through daily construction monitoring. Subsequent plantings and/or seedlings will follow using species selected from the coastal strand and dune palette (see below).

4.5 Revegetation

Both restored dunes and created dune form areas will be revegetated with planting mixtures generally mimicking the plant composition of the vegetation types mapped for the Signal Hill Dune (Appendix A). The need and timing for introduction of plant materials into an area will vary with the objectives of each designated management area (see below) and will be closely tied to the non-native species eradication schedule. Plant material (e.g. seeds, cuttings, root divisions, seedlings, whole plants) will be collected from on-site (Signal Hill Dune) stock and either applied directly or grown on/propagated in the Pebble Beach Company native plant nursery until such time as outplanting can be completed with optimum success. The need for supplemental irrigation, fertilization or other relatively high maintenance plant establishment

techniques will be reduced in most management areas by the use of appropriate native species at an appropriate life stage introduced at an appropriate time of year. However, in those areas requiring more aggressive restoration/establishment (e.g. formerly mined substrates, created dune landforms), supplemental irrigation, fertilization and other standard landscaping practices may be necessary. Contingent upon permission from the California Department of Fish and Game for the collection of seeds, restored dune habitat shall be supplemented with salvaged or propagated seeds or individuals of special-status dune plant species (e.g., Tidestrom's lupine, sand gilia, Monterey spineflower, beach layia).

4.6 Access Controls

One official trail (the Del Monte Forest "Green Trail") traverses the southerly-facing slope of the Signal Hill Dune and receives regular use by pedestrians and equestrians alike (Figure 2). A main branch off this trail follows the alignment of a former access road that once extended from Signal Hill Road to the former gun club adjacent to Spyglass Pit. Any paved or otherwise hard surface that may have once been associated with this road is no longer evident, except in the vicinity of the former gun club, and no motorized vehicles are now allowed on the dune. However, uncontrolled access through the Signal Hill Dune area has resulted in numerous unplanned paths and trails through dune habitats (see Figure 2). Introduction of new recreational (i.e. golf) use into the area could further exacerbate this situation and provide the added complication of errant ball retrieval in restored and created dune areas. In addition, spectators at competitive events could pose a serious threat to dune areas without proper controls.

As a component of the restoration program, a formalized trail system through the Signal Hill Dune will be established and maintained. The Green Trail (or its equivalent) will remain as the main thoroughfare through Signal Hill and will continue to accommodate both pedestrians and equestrians. However, equestrian use will be directed to areas that can withstand (and/or have been designed to withstand) constant trampling. More permanent (possibly structural) dune stabilization techniques (e.g. erosion blankets, jute netting, snow fencing) may be applied on some of the more pronounced eroded slopes along the trail (see Photo 4). Barriers such as post and cable or split rail fencing may need to be installed to keep horses (and their riders) on the designated trail. Parallel boardwalks for pedestrians may also have to be installed in some areas. In addition, pedestrian boardwalks through other parts of Signal Hill will be considered to direct foot traffic through the dunes, allowing for the restoration of unplanned trails and further protection of dune habitat. Restored trails and habitat restoration areas shall be designated by signage and/or barriers, which would become progressively more stringent as necessary.

A boardwalk connection across the dune area between one of the main dune trails and the 15th tee will provide golf access to the 15th, 16th and 17th holes. Golf course tees, greens and fairways, and access to them in the restored dune area, have been designed so that the logical flow of pedestrian traffic follows boardwalks or other hardened pathways and avoids direct encroachment into dune habitat. Barriers such as split rail fences and stone retaining walls

(i.e. around the 16th tee) will further separate golf from restored dunes. Tees of holes 15 and 16 shall be raised sufficiently to prevent conflict between fences and golf ball flight lines over them or over golf cart parking areas. Golf cart parking for holes 15, 16, and/or 17 shall be designated and signed. Marshalls shall be empowered to enforce access restrictions and positive incentives (e.g. free replacement balls) will further discourage access for the purposes of ball retrieval.

Spectators at competitive events shall be directed to specifically designated gallery areas that will be planted with hardy dune species (e.g. dune sedge) or otherwise designed to accommodate such periodic heavy use. Spectator access to restored and created dune habitat areas will be also be prevented by means of temporary fences erected outside habitat areas and/or continuous presence of security personnel.

4.7 Management Areas

Management areas have been delineated within the Signal Hill Dune/Spyglass Pit area to address site-specific dune restoration, enhancement and management objectives particular to each area (Figure 5). Habitat types (or target habitat types) within each management area have also been characterized (Appendix A). The delineation of management areas is based on existing conditions and conservation goals as well as the proposed development and public use/access plans for different portions of the area. The management objectives for each area will be used to develop a set of specific management prescriptions and performance standards to be implemented and monitored by the Pebble Beach Company in perpetuity. These management objectives are intended as guidelines and not as fixed criteria. As experience with dune restoration and management techniques and golf course use in the area increases over time, these objectives may be adapted in response to new techniques, information and/or changing circumstances.

4.7.1 Management Area 1: Dune Crest & Upper Slopes of Signal Hill

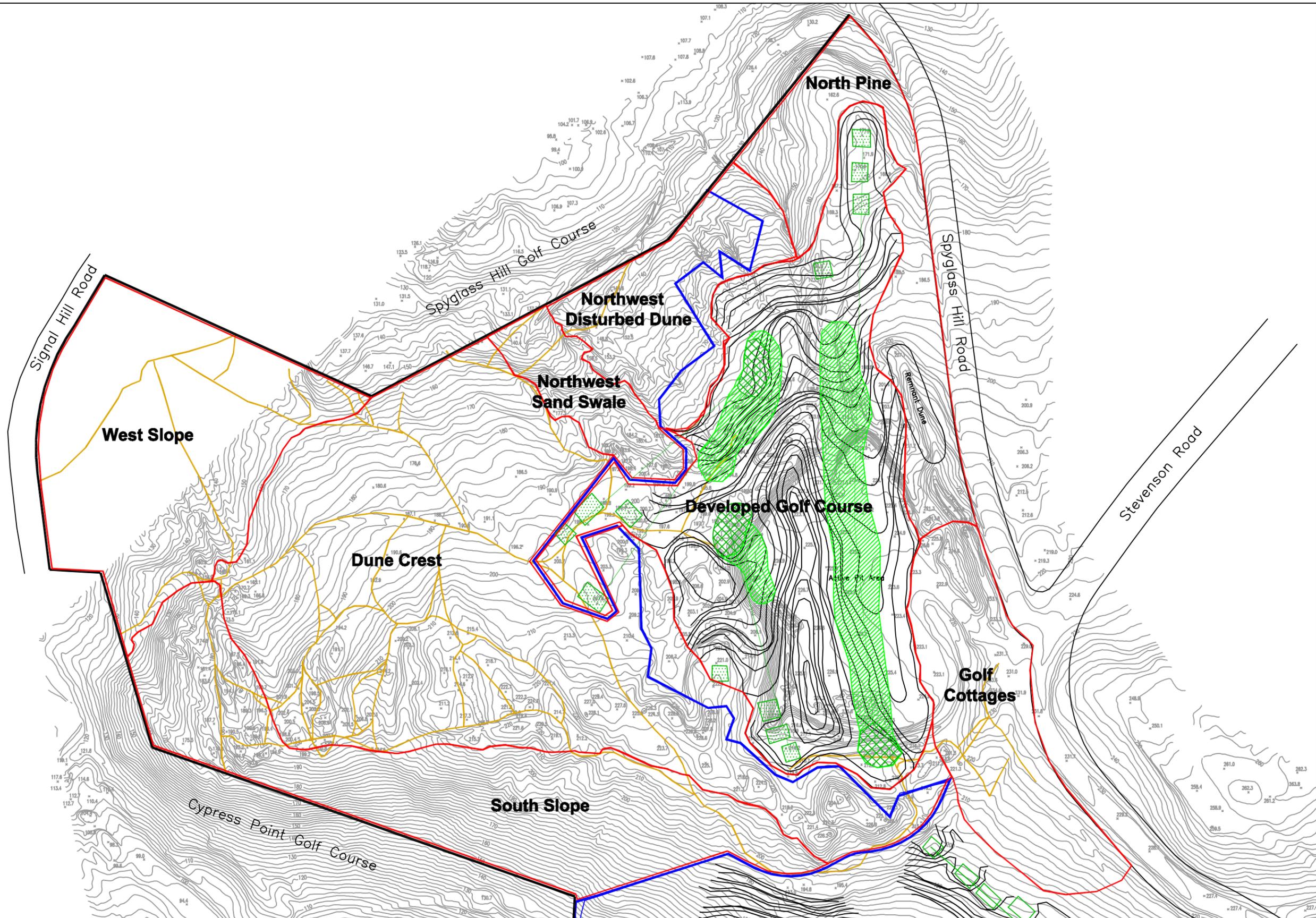
Description of Area

The crest and upper slopes of Signal Hill are relatively heavily vegetated by Monterey pine and coastal scrub vegetation. Dune (strand) vegetation is also represented, but to a lesser extent, and comparatively little habitat for special-status annual plants (i.e. open sands) occurs in the upper areas of the dune. Iceplant mats form a dominant understory under the pines in many places and also compete for space with coastal scrub and dune elements. A few Monterey cypress trees (*Cupressus macrocarpa*), which may represent the northern-most extent of the Cypress Point population, also occur near the crest of Signal Hill (Plate 1).

The dune crest and upper flanks are more or less stable, but riddled with a network of trails and footpaths that cause localized erosion and blowouts. The Del Monte Forest Green Trail passes along the southerly flank of this management area and its main branch rises through

LEGEND

- Management Areas
- Trails
- ESHA Boundary
- DMF Plan Boundary



Scale: 1" = 200'

the center of the dune, creating the opportunity for off-trail exploration and its accompanying cumulative effects on dune habitat. This disturbance along with the constant threat of competition from iceplant and other non-native invasive plants pose the primary management challenges for this management area.

Management Objectives

The systematic removal of iceplant by both chemical and mechanical means is a priority for this management area. Other non-native species should also be eliminated over time but the reduction in the amount of cover of iceplant will provide opportunity for the recolonization and establishment of natives that currently occupy the dune crest area and contribute significantly to its stability and habitat values. Because of the relatively dense cover and reduced exposure throughout most of this area, aggressive dune stabilization measures are not as critical as in other areas. Similarly, the need for the introduction of plant materials for revegetation is reduced because of the ample source material for natural recruitment and recolonization once competition from iceplant is reduced. More exposed, open sand areas on the dune crest and upper flanks may require modification to this management approach following principles similar to those for the south-facing and westerly-facing flanks of the dune (see below).

Equally important for this management area is the definition and management of access, particularly associated with the Green Trail and its branches through the dune crest. Main trails should be clearly delineated and maintained while unplanned footpaths, eroded areas and blowouts should be eliminated and restored to dune habitat. Pedestrian and equestrian traffic should be actively directed onto designated trails using a combination of signs, barriers and boardwalks through more sensitive dune sand areas. An official trail map of Signal Hill and informative materials describing its sensitivity should be available at key entrance points to the dune.

4.7.2 Management Area 2: South Slope Signal Hill

Description of Area

The South Slope management area is situated on the south-facing slopes between the upper reaches of the Signal Hill Dune and the Cypress Point Golf Course. The Del Monte Forest Green Trail more or less divides this management area from the Dune Crest Management Area upslope. The south slope area is relatively open with a more sparse pine canopy cover than the crest area but not as exposed as the more westerly and north-westerly-facing flanks of Signal Hill (see below). A higher percentage of open sand or sparsely vegetated areas that provide habitat for sand gilia, Tidestom's lupine and beach layia occur on these south-facing slopes. Blowouts and unstable sand are more frequent with European beach grass stabilizing the slopes in closer proximity to the Cypress Point Golf Course. Some minor unplanned trails also pass through this area.

Management Objectives

As with the Signal Hill Dune Crest management area (and all other areas of natural sandy substrates on Signal Hill), eradication of non-natives, primarily iceplant, is a priority here. However, European beach grass also poses a problem in this area, especially at the interface between the dune edge and the Cypress Point Golf Course. Blanket application of herbicide is not recommended in this management area because of the frequent association of coastal scrub and dune species, including special-status species, with iceplant, beach grass and other invasives. Except where large masses of iceplant are clearly dominant, spot-spraying or hand removal are the preferred methods of removal. Dead material can remain as mulch in heavier coastal scrub-dominated areas, but should be removed in more open sandy and dune strand areas. Active re-introduction of appropriate native plant materials should occur in areas where non-natives have been removed, but natural colonization should be the preferred method of vegetation establishment in this management area. Some introduction of special-status species, propagated from site-specific source material, could be considered. Periodic control and maintenance of eroded areas and blowouts will also be required in this area, but major stabilization or structural improvements should not be necessary due to the area's limited accessibility and relatively better protection from the prevailing offshore winds. Access control is also of secondary priority in this area since it does not currently receive heavy use. Directional signage along the Green Trail at the top of the management area should be adequate to control cross-country traversing through the area.

4.7.3 Management Area 3: West Slope Signal Hill

Description of Area

The west slope of Signal Hill, located between Signal Hill Road and the dune crest, is probably the most exposed and open area of the dune with a higher percentage of sparsely vegetated sandy substrates than most other areas (with the possible exception of the northwest sand swale area—see below). There is virtually no tree cover in this area, extensive stretches of open sand and large patches of iceplant in competition with dune strand and scrub vegetation. The Del Monte Forest Green Trail bisects the area on its route toward the 3rd hole of the Spyglass Hill Golf Course and Seventeen Mile Drive. The upper reaches of this trail have been well incised in the sand with some stability afforded by iceplant mats (see Photo 4). Blowouts and windblown sand occur, but they appear to be less damaging to habitat than might be expected, possibly because of the relatively gradual slopes on this flank. The area provides habitat for special-status species including Menzies' wallflower, Tidestrom's lupine and beach layia.

Management Objectives

Eradication of non-natives, primarily iceplant, is also a priority here. Broadcast spraying is acceptable where iceplant mats occupy otherwise barren sandy substrates, but stabilization measures (e.g. early establishment of vegetative windrows, straw crimping) should be planned

into the eradication program to prevent the movement of sand in the absence of the stabilizing effects of iceplant. Spot-spraying or hand removal will be necessary where coastal scrub and dune species mix with iceplant. As in the South Slope management area, dead material can remain as mulch in heavier coastal scrub-dominated areas, but should be removed in more open sandy and dune strand areas. Active re-introduction of appropriate native plant materials including dune stabilizing species suited to more open sand areas like beach sagewort (*Artemisia pycnocephala*), beach knotweed (*Polygonum paronychia*), dune bluegrass (*Poa douglassii*) and special-status species such as Menzies' wallflower and Tidestrom's lupine should occur in areas where non-natives have been removed.

Trail identification and maintenance through this area is also important. With the Green Trail passing directly through the area and its frontage along Signal Hill Road, the West Slope management area is subject to inappropriate access and trail degradation. The Green Trail, especially at its upper entrance to the area, needs some structural improvement to arrest the gullying and erosion associated with it. Iceplant that currently stabilizes the slopes of this section of trail should be replaced by a combination of structural erosion controls (e.g. matting, snow fencing, wooden retaining walls) and hardy coastal scrub vegetation (mock heather (*Ericameria ericoides*), dwarf coyote brush (*Baccharis pilularis*)). Other trails through the area should be clearly designated with possibly an interpretive boardwalk trail off of Signal Hill Road or Spyglass Hill Golf Course. Periodic control and maintenance of eroded areas and blowouts will also be required in this area

4.7.4 Management Area 4: Northwest Sand Swale

Description of Area

This relatively small, contained area of open, windblown sand is situated at the interface of the remnant natural dune substrates of Signal Hill and the heavily mined area associated with Spyglass Pit. In fact, this area more or less defines the boundary for remnant dunes established in the Del Monte Forest Land Use Plan (see Figure 2). The area probably developed as the result of a blowout and was either not considered substantial enough for mining or filled in with sand subsequent to the cessation of mining. In any case, depths of sand in the area vary but on average appear to be comparatively shallow and habitat values are not high. Iceplant has formed extensive mats and clay shards from the former gun club cover portions of the area (see Photo 14). Nonetheless, the area supports both Tidestrom's lupine and beach layia and offers reasonable restoration potential.

Management Objectives

Removal of iceplant and other non-native invasive species and sand stabilization are the key management objectives of this area. Broadcast spraying in most of the area is the method of choice since very little native dune habitat remains. Even in those areas known to support special-status plants, such spraying can be completed prior to their emergence in the spring or after they have completed their life cycle in the summer without substantial consequences on

the populations. Sand stabilization, however, must be considered prior to implementation of the spraying program. Without iceplant, sand movement in this area could be damaging. Straw crimping and seeding with an appropriate native nurse crop (such as beach sagewort (which was used to good effect on the restored dunes at former Fort Ord) may be an appropriate method for both sand stabilization and introduction of native dune species in this management area. Vegetative windrows with woody materials such as mock heather and coyote brush could also help stabilize the area. Supplemental irrigation and possibly overhead spray may be necessary to keep the sand moist until vegetation is established. A combination of methods and techniques may be applied and adapted in response to interim results. Debris (i.e. clay shards from the gun club) should also be removed in this area. Because of its inherent instability, no pathways or trails should be routed through the area, but boardwalks through the created dune landforms associated with the golf course and viewing platforms above the area (see below) may be created to overlook this area.

4.7.5 Management Area 5: Northwest Disturbed Dune

Description of Area

This management area lies just northwest and downslope from the Spyglass Pit area and supports primarily ruderal and colonizing vegetation on highly disturbed and scoured substrates. The area was actively mined so that most of the surficial sand deposits were scraped away leaving a hardened mineral base. The area was not included in the original LUP-designated remnant Signal Hill Dune (Figure 2) but was mapped as a component of the dune ESHA by the 1995 survey, primarily because of the presence of special-status species (beach layia and Tidestrom's lupine) in limited areas (see Figure 3). Non-native grasses and herbs vie with pioneer species like bush lupine and Monterey pine to gain a foothold on these disturbed soils (see Photos 9 & 10). Coastal scrub vegetation dominates in some sections, notably toward the base of the slope on more developed substrates near the Spyglass Hill Golf Course, while large clumps of acacia and iceplant mats take over on the shallower soils upslope (Plate 1).

Management Objectives

Non-native species eradication in this management area will be difficult because of the mixed vegetation that has colonized the area since abandonment of the mining operation. On one hand, physical removal of large acacia trees and chemical removal of large clumps of iceplant and pampas grass will be relatively straightforward and should proceed as a first step. On the other hand, pioneering elements of both dune strand and dune scrub vegetation along with Monterey pines have begun to colonize the area. In addition, both Tidestrom's lupine and beach layia occur on remnant sands in the area. Consequently, spot spraying or hand removal of non-natives is the preferred method of non-native plant control.

While sandy substrates presumably once characterized the entire area, reestablishing this condition throughout the area would probably not be feasible and would likely create more

problems than it would resolve. Limited sand placement will be included on the edges of the area as part of the new dune landform creation associated with the golf course (see below). However, the theme for this management area should remain as a coastal scrub-dominated habitat with pioneering species and Monterey pines comprising the dominant vegetation. An active plant establishment program along those lines should be developed for the area. In addition, various soil treatment/scarification techniques should be evaluated and revegetation measures adapted in response to those techniques.

4.7.6 Management Area 6: North Pine Forest

Description of Area

This area is located at the northernmost extent of the planning area and represents a transition to the more typical Monterey pine forest (with herbaceous understory) found in upper Spyglass Hill rather than pines on dunes as found on the crest of Signal Hill. Younger dune deposits appear to transition into more typical forest substrates at the northerly end of Spyglass Pit and, consequently, the area was not subject to heavy disturbance from mining activity. However, a small remnant dune is located along the easterly edge of this management area parallel to Spyglass Hill Road. For planning purposes, this small dune area along with the ruderal habitats surrounding it that are outside of the grading limits for the golf course are included in the North Pine Forest management area.

Management Objectives

The forest in this area is fragmented but more or less intact and should be managed as a productive landscape element in the context of golf course development and similar forest areas throughout the greater Del Monte Forest (see also Forest Management Section). Non-native and ruderal species such as French broom, acacias, European grasses and other weeds should be regularly eliminated, both to maintain the integrity of the forest environment and to reduce the potential sources for colonizing the adjacent dunes. Clearance of the understory should be kept to the minimum necessary for golf play. Natural Monterey pine and associated species regeneration (and pitch canker) should be monitored and replacement planting pursued in keeping with the overall Forest Management Plan (see Forest Management Section). The small area of remnant dune along Spyglass Hill Road should be restored in keeping with the management objectives of other natural sandy substrate areas (see above) and incorporated into the management of the newly created dune landforms associated with the golf course (see below). Access to and through this management area should be directed through the use of signs and clearly delineated trails.

4.7.7 Management Area 7: Developed Golf Course Area

Description of Area

This management area is established by the limit of grading line for golf course construction and includes all recontoured ground in the Spyglass Pit area that will be converted to golf course and associated facilities, including landscaped areas and newly created dune landforms. The area is currently occupied by the active pit and disturbed lands adjacent to it. Ruderal and ruderal/native colonizing vegetation along with iceplant, acacia and other invasive species are the primary vegetation types (Figure 3). All of this vegetation will be removed and replaced with turf and introduced landscape elements following golf course grading. Sandy soils will be used to create dune landforms in the context of the new golf course (Figure 4) and these will be designed and planted for compatibility with surrounding restoration areas.

Management Objectives

As noted previously, the new golf course has been designed for compatibility with the dune environment and to provide added enhancement opportunity through the creation of new dune landforms supporting coastal dune and scrub vegetation in the context of golf. While all environmentally sensitive habitat areas adjacent to the new course will be avoided and protected by effective buffer zones and/or barriers, no designated restoration areas will be located within the perimeter of the golf course; dune landforms created within the perimeter of the course shall be regarded and managed as landscape features rather than habitat mitigation. Consequently, their management requirements will be less environmentally stringent than strictly-defined restoration areas. Access to and through them will be less constrained by habitat considerations, the plant palette will tend toward more ornamental (but locally indigenous) and otherwise utilitarian (e.g. plants that can accommodate heavy foot traffic like dune sedge) native dune species and they will be regularly maintained as landscape features. Nonetheless, the species mixes will be compatible with native dune restoration objectives and the source of non-native invasive weeds will be virtually eliminated. The irrigation system will be designed to ensure that, under windless conditions, restored dune habitat is not subject to substantial overspray. The topography of the adjacent golf areas will be graded to collect and divert all surface runoff (both from irrigation and from rain) away from the restored dunes. The drainage system shall be located in the golf area rather than in the restored dune habitat.

Golf play will be restricted and actively directed, also as noted previously. The logical traffic pattern of golfers and the movement of spectators will be oriented away from restored dune areas, errant golf ball recovery will be disallowed in restored dune areas and Marshalls, signage, and positive incentives will all be used to emphasize these standards.

4.8 Monitoring

The Pebble Beach Company will monitor the success of the dune restoration program by regularly evaluating use patterns in the dunes and by gathering percent cover data for native and non-native plant species. Periodic (a minimum of monthly) walks through the dune area to evaluate off-trail use, accelerated disturbance due to human-induced or natural phenomena

(e.g. blowouts), signage and barrier effectiveness and other parameters will be conducted by a designated monitor with specific reporting responsibility.

Percent cover data for plants will be collected from permanent transects located in each management area to cover all habitat types from the coastal scrub through the coastal strand habitat to Monterey pine forest. The location, length and spacing of these transects and exact methods of data collection shall be developed as part of a baseline assessment and report to be produced in the first year following project approval. Special-status annual plant species (i.e. sand gilia, Tidestrom's lupine, beach layia, Monterey spineflower, coast wallflower) will be monitored each year at the appropriate time with actual counts or population estimates each year. Success criteria for dune restoration will be based on acceptable percent cover standards, population sizes for special status species and other factors as determined through comparison with equivalent data from identified reference sites. In addition, to be considered successfully restored, these dune areas shall have no greater than ten percent of their plant cover composed of non-native, invasive species.

The Pebble Beach Company will initiate the dune restoration program immediately upon project approval and will establish a ten-year planning horizon for achieving restoration success criteria within all management areas. As noted above, a baseline assessment report will be produced in the first year following project approval. This baseline assessment will document existing conditions (e.g. provide as-built plans for the golf course and dune landforms, if complete), establish transect locations, develop a restoration schedule and generally set the standards for subsequent monitoring and reporting. Subsequent monitoring and reporting will be conducted on an annual basis for the initial ten year period. Ongoing dune restoration monitoring beyond this initial period will occur at no greater than five year intervals with monitoring reports produced within a year of each monitoring event.

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PHOTOGRAPHS

**DMF Plan – Biological Resource Assessment
Dunes Section**



Photo 1: Monterey pine with dune sedge understory stabilizing upper slope at Signal Hill Dune.



Photo 2: Coastal scrub vegetation stabilizing upper slopes of Signal Hill Dune.

**DMF Plan – Biological Resource Assessment
Dunes Section**



Photo 3: Monterey pine with ice plant understory at the top of the Signal Hill Dune.



Photo 4: Iceplant colonizing slopes of disturbed equestrian trail through flanks of Signal Hill Dune.

**DMF Plan – Biological Resource Assessment
Dunes Section**



Photo 5: Areas of open sand and dune vegetation on the flanks of the Signal Hill Dune that provide habitat for special-status species.



Photo 6: Areas of open sand and dune vegetation on the flanks of the Signal Hill Dune that provide habitat for special-status species.

**DMF Plan – Biological Resource Assessment
Dunes Section**



Photo 7: Indian Village remnant dune sharing a good mix of coastal dune and scrub vegetation with relatively little non-native cover.



Photo 8: Indian Village remnant dune supports habitat for special-status species like Menzies' wallflower (pictured).

**DMF Plan – Biological Resource Assessment
Dunes Section**



Photo 9: Mined dune area with bare mineral soils supporting mostly non-native species and native colonizers like Monterey pine and bush lupine.



Photo 10: Non-native grasses and Acacia compete with lupine and pine on these scraped sands.

**DMF Plan – Biological Resource Assessment
Dunes Section**



Photo 11: Iceplant mats and pampas grass (foreground) colonize disturbed sand in formerly mined area.



Photo 12: Large cluster of Acacia (background) and ice plant mats leave little room for native vegetation.

**DMF Plan – Biological Resource Assessment
Dunes Section**



Photo 13: Fragment of dune sand and native dune habitat with encroaching non-native species westerly of the active Spyglass Pit area.



Photo 14: Area of relatively open, deeper sands with encroaching ice plant and clay target shards (dark sands in mid-ground) westerly of active pit.

APPENDIX A

SIGNAL HILL DUNE/SPYGLASS PIT VEGETATION ASSESSMENT

**APPENDIX A:
SIGNAL HILL DUNE/SPYGLASS PIT
VEGETATION ASSESSMENT**

INTRODUCTION

During April and May 2001, vegetation types in the Signal Hill Dune/Spyglass Pit area of the Del Monte Forest within Pebble Beach Company ownership were evaluated and mapped. A relatively large scale (1 inch = 100 foot) color aerial photograph and companion registered topographic map were used in the field for orientation and determination of the extent of vegetation coverage. Polygon mapping based on imagery from the aerial photography supplemented by ground-truthing was completed. Systematic searches for several special-status species known or suspected to occur in the Signal Hill Dune area were also completed.

VEGETATION CATEGORIES

Ten different vegetation categories were assigned to the area as follows:

- Acacia—This category was established for large clumps of acacia occurring over almost 100% of defined polygon areas.
- Cypress—This category was established for individual cypress trees creating defined polygon areas.
- Pine—This category was established for both individual Monterey pine trees creating defined polygon areas and groupings (groves) of trees whose canopies define a mapped polygon.
- Disturbed Sand—This category was assigned to formerly mined areas with mostly barren mineral substrates and limited (less than 20%) vegetative cover.
- Open Sand—This category was assigned to open, native sand areas with limited (on average less than 20%) vegetative cover.
- Iceplant—This category was established for large clumps of iceplant occurring over almost 100% of defined polygon areas.
- Ruderal—This category was established for a mix of primarily non-native colonizing species occupying disturbed ground (either unconsolidated fill or graded/scraped soils). Very little (less than 10%) naturally-occurring plant material or undisturbed substrates were identified where this category was mapped.
- Ruderal/Colonizing—This category also occurs on disturbed (mostly mined/scraped) substrates but supports almost equal percentages of non-native (mostly introduced European

grasses and herbs) and aggressive colonizing native plants such as bush lupine, coyote brush and Monterey pine.

- Coastal Scrub—Coastal scrub vegetation was determined by a predominance (greater than about 75% cover) of woody shrubs typical of the coastal environments of Monterey County (see attached list).
- Dune—Coastal dune (strand) vegetation was determined by a predominance (greater than about 75% cover) of mostly herbaceous plants typical of the near coastal environments of the Monterey County shoreline (see attached list).

MAPPING METHODOLOGY

Polygon areas were established by using the aerial photograph and ground-truthing the imagery. These areas were evaluated and mapped based on dominance of one type of vegetation or on combinations of two or three types. One vegetation type was mapped if that type covered greater than 75-80 % of the polygon area considered. Two vegetation types were combined if each occurred at a coverage ranging between approximately 30% and 70% with no third co-dominant type. Three types were combined if all three averaged between 30 and 40% coverage of the area considered. Monterey pine was mapped based on canopy coverage and considered the dominant type even if understory vegetation was comprised of other elements (usually iceplant). Disturbed sand and open sand categories were established in areas that supported less than about 20% vegetative cover.

SPECIAL-STATUS SPECIES

Directed searches for Monterey spineflower (*Chorizanthe pungens* var. *pungens*), Menzies' wallflower (*Erysimum menziesii*), beach layia (*Layia carnosa*), sand gilia (*Gilia tenuiflora* var. *arenaria*) and Tidestrom's lupine (*Lupinus tidestromii* var. *tidestromii*) occurred throughout the area during the months of April and May 2001. General locations for these species were noted on the base field maps as they were identified.

RESULTS

The results of the mapping exercise were digitized and produced as an electronic layer on the CADD-based map set for the Del Monte Forest Plan. Plate 1 presents this information.

COASTAL SCRUB SPECIES

SHRUB PLANTS:

Adenostoma fasciculatum

Artemisia californica

Baccharis pulularis

Ceanothus thyrsiflorus

Ericameria ericoides

Eriogonum parvifolium

Eriophyllum staechadifolium

Lotus scoparius

Lupinus arboreus

Mimulus aurantiacus

Rhamnus californica

Rosa californica

Salvia mellifera

Toxicodendron diversilobum

HERBACEOUS PLANTS:

Abronia latifolia

Abronia umbellata

Agrostis hybrid

Amsinkia spectabilis

Artemisia pycnocephala

Astragalus nuttallii

Camissonia cheiranthifolia

Calamagrostis nutkaensis

Carex pansa

Castilleja latifolia

Dudleya caespitosa

Erigeron glaucus

Eriogonum latifolium

Galium californicum

Grindelia latifolia

Iris douglasiana

Lathyrus littoralis

Lessingia filaginifolia

Leymus condensatus

Linaria Canadensis

Lotus heermannii

Lotus strigosus

Lupinus chamissonis

Marah fabaceus

Oenothera hookeri

Phacelia ramosissima

Poa douglassii

Pteridium aquilinum

Rumex salicifolius

Scrophularia californica

Sidalcea malviflora

Sisyrinchium bellum

Stachys bullata

Stipa lepida

Streptopus amplexifolius

chamise

California sagebrush

dwarf coyote brush

California lilac

mock heather

wild buckwheat

lizardtail

deerweed

yellow bush lupine

sticky monkey flower

coffeeberry

California wild rose

purple sage

poison oak

yellow sand verbena

pink sand verbena

bent grass

popcorn flower

beach sagewort

rattleweed

beach evening primrose

pacific reed grass

dune sedge

seaside painted cup

liveforever

seaside daisy

coast buckwheat

bedstraw

gumplant

Douglas iris

beach pea

beach aster

giant wildrye

blue toadflax

lotus

lotus

purple bush lupine

man root

evening primrose

branching phacelia

dune blue grass

bracken fern

willow- leaf dock

California figwort

checker bloom

blue-eyed grass

hedge nettle

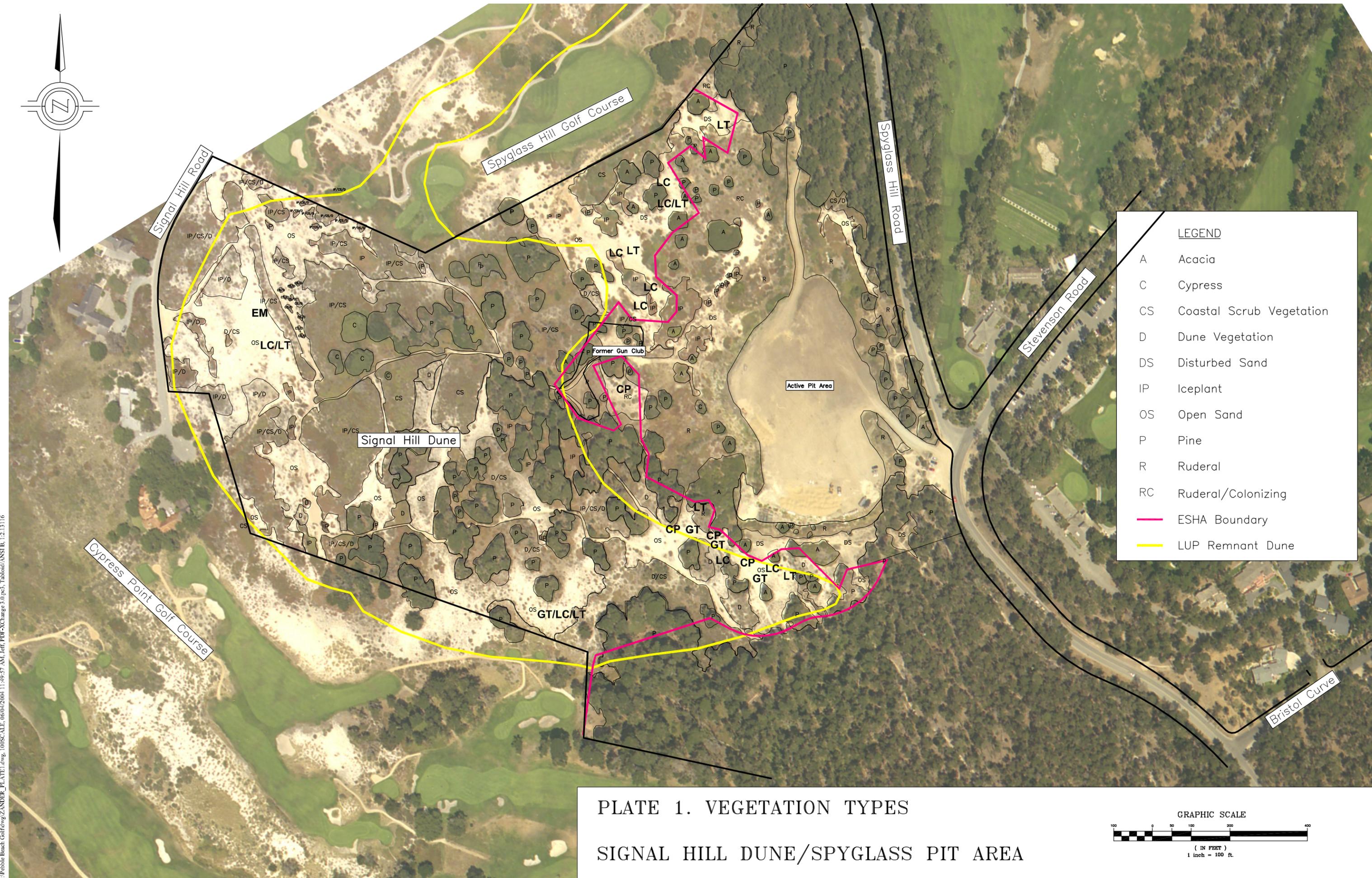
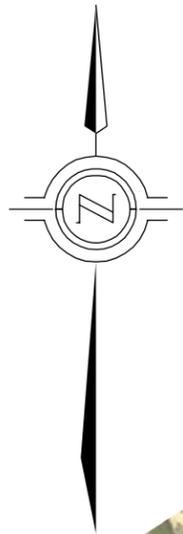
needlegrass

twisted stalk

COASTAL DUNE/STRAND SPECIES

<u>Scientific Name</u>	<u>Common Name</u>
<i>Abronia latifolia</i>	Pink sand verbena
<i>Abronia umbellata</i>	Yellow sand verbena
<i>Achillea borealis</i>	Yarrow
<i>Ambrosia chamissonis</i>	Beach Bur
<i>Armeria maritima</i> var. <i>californica</i>	Sea Pink
<i>Artemisia pycnocephala</i>	Dune sagebrush
<i>Cakile maritime</i>	Searocket
<i>Camissonia cheiranthifolia</i>	Beach Primrose
<i>Carex pansa</i>	Dune sedge
<i>Castilleja latifolia</i>	Painted Cup
<i>Chorizanthe pungens</i> var. <i>pungens</i>	Monterey spineflower
<i>Convolvulus soldanella</i>	Beach Morning Glory
<i>Corethrogyne californica</i>	Beach aster
<i>Corethrogyne leucophylla</i>	Beach branching aster
<i>Dudleya caespitosa</i>	Live Forever
<i>Elymus mollis</i>	Dune grass
<i>Erigeron glaucus</i>	Seaside daisy
<i>Eriogonum latifolium</i>	Coast buckwheat
<i>Eriogonum parvifolium</i>	Dune buckwheat
<i>Eriophyllum staechadifolium</i>	Lizardtail
<i>Erysimum menzesii</i>	Menzies wallflower
<i>Eschscholzia californica</i> var. <i>maritima</i>	Dune poppy
<i>Fragaria chiloensis</i>	Beach strawberry
<i>Gilia tenuiflora</i> spp. <i>arenaria</i>	Sand gilia
<i>Grindelia stricta</i> var. <i>venulosa</i>	Dune gumplant
<i>Juncus lesueurii</i>	Salt rush
<i>Lathyrus littoralis</i>	Beach pea
<i>Layia carnosa</i>	Beach layia
<i>Lessingia filaginifolia</i>	Beach aster
<i>Leymus mollis</i>	Pacific dunegrass
<i>Lotus hermanii</i>	Deerweed
<i>Lupinus arboreus</i>	Yellow Bush lupine
<i>Lupinus chamissonis</i>	Dune lupine
<i>Lupinus tidestromii</i>	Tidestrom's lupine
<i>Marah fabaceus</i>	Bigroot
<i>Phacelia ramosissima</i> var. <i>montereyensis</i>	Phacelia
<i>Poa douglasii</i>	Douglas' bluegrass

PLATE 1
VEGETATION TYPES



LEGEND	
A	Acacia
C	Cypress
CS	Coastal Scrub Vegetation
D	Dune Vegetation
DS	Disturbed Sand
IP	Iceplant
OS	Open Sand
P	Pine
R	Ruderal
RC	Ruderal/Colonizing
	ESHA Boundary
	LUP Remnant Dune

PLATE 1. VEGETATION TYPES
SIGNAL HILL DUNE/SPYGLASS PIT AREA

