Variegated Dudleya Translocation Plan for the Castlerock Project City of San Diego Project No. 10046

Prepared for

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1.0 Introduction

Pardee Homes is proposing a residential development at the Castlerock site in the city of San Diego, California (Figures 1 and 2). This report evaluates two project development scenarios (proposed project) for this site. The first scenario (Annexation Scenario) assumes that the City of San Diego approves the project, but the project is subsequently annexed into the city of Santee. For the Annexation Scenario, Pardee Homes proposes to develop approximately 108.72 out of a total of 203.64 acres of the Castlerock site for residential use (Natural Resource Consultants [NRC] 2012; Figure 3a). The Annexation Scenario would result in the construction of 283 detached single-family residences, 147 single-family detached units clustered on larger lots (referred to as green court units), approximately 4.0 acres (gross) of public parks, 0.64 acre (gross) and 0.49 acre (usable) of pocket parks, a pedestrian trail, and public streets and private driveways on an undeveloped 203.64-acre site within the East Elliott Community Plan. The remainder of the property (94.92 acres) would remain undisturbed as open space, except for small areas needed for brush management. Access to the Annexation Scenario would be provided from Mast Boulevard to the south.

The second scenario (No Annexation Scenario) assumes the project is not annexed into the city of Santee and remains within city of San Diego. For the No Annexation Scenario, Pardee Homes proposes to develop approximately 108.91 out of a total of 203.64 acres of the Castlerock site for residential use (NRC 2012; Figure 3b). Due to the additional infrastructure requirements, the No Annexation Scenario has one less detached single-family residence. The No Annexation Scenario would involve minor changes in the land uses with 282 detached single-family residences, 140 single-family detached small lot units (referred to as green court units), approximately 4.0 acres (gross) of public parks, 0.50 acre (gross) and 0.39 acre (usable) of pocket parks, a pedestrian trail, and public streets and private driveways and 94.73 acres of open space.

This translocation plan addresses the impacts to variegated dudleya (*Dudleya variegata*) that would result from implementation of either the Annexation Scenario or No Annexation Scenario for the Castlerock development. This plan describes methods of salvaging variegated dudleya from the Castlerock development site, as well as propagation of additional dudleya from seed. This plan also details the five-year monitoring, maintenance, and reporting program as required by the City of San Diego. The purpose of the monitoring program is to make observations and collect data on survivorship and flowering of the translocated population so that the progress of the mitigation effort can be assessed. The purpose of the maintenance program is to remove weeds in the surrounding habitat so that the translocated population may establish, and to minimize future weed invasion at the receiver site.

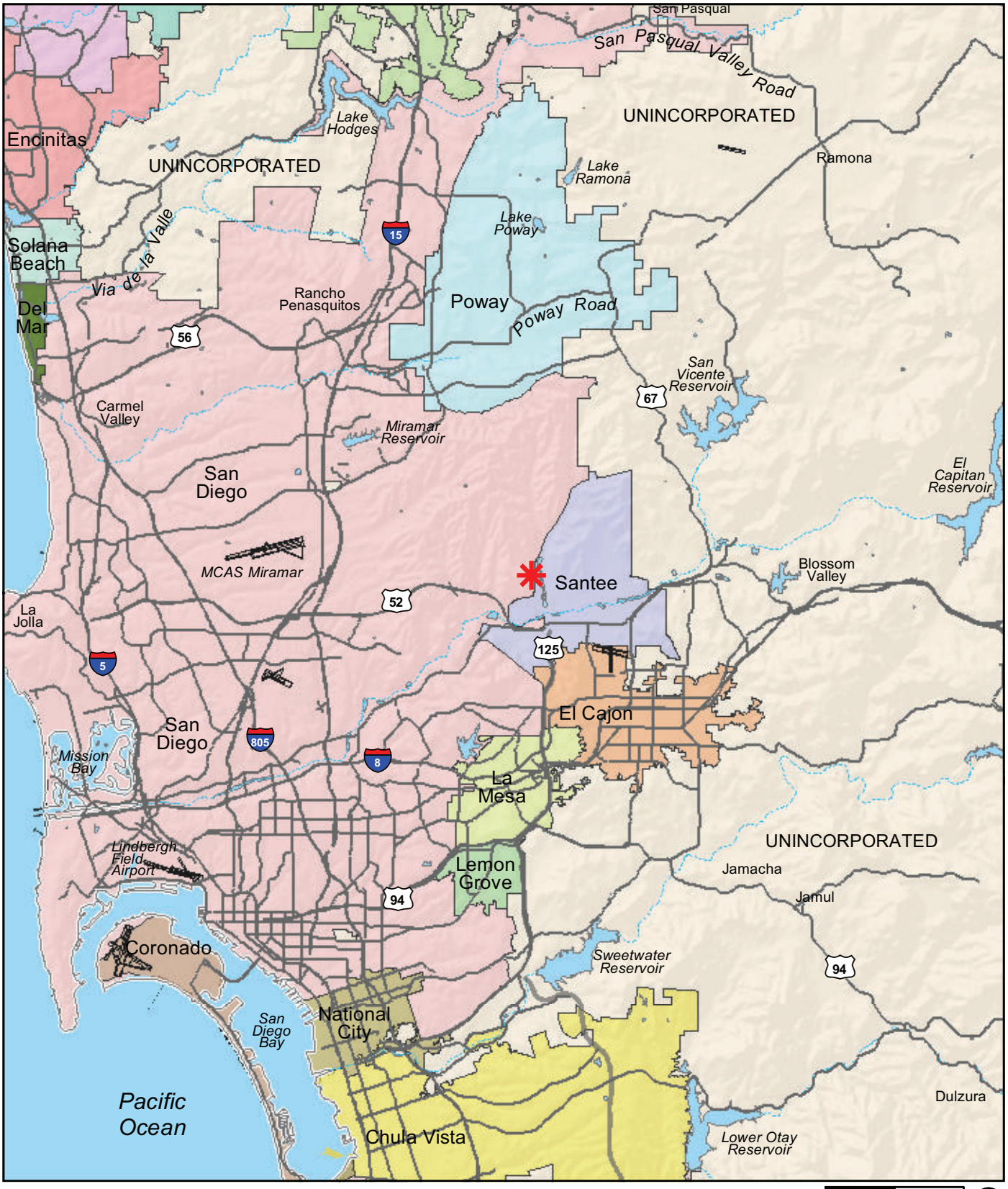

FIGURE 1

Regional Location

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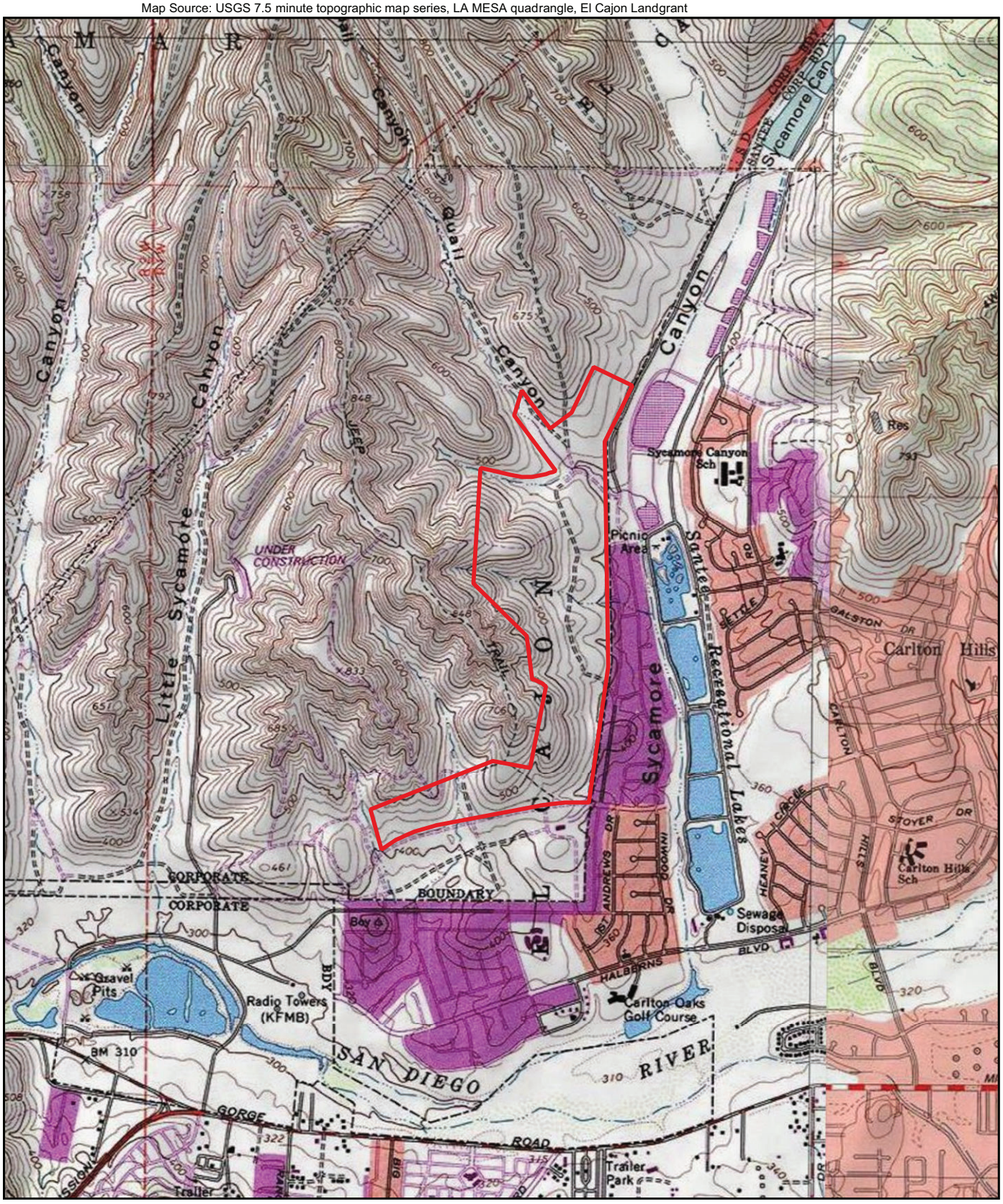
Map Source: USGS 7.5 minute topographic map series, LA MESA quadrangle, El Cajon Landgrant



Project Boundary

FIGURE 2

Project Location on USGS Map

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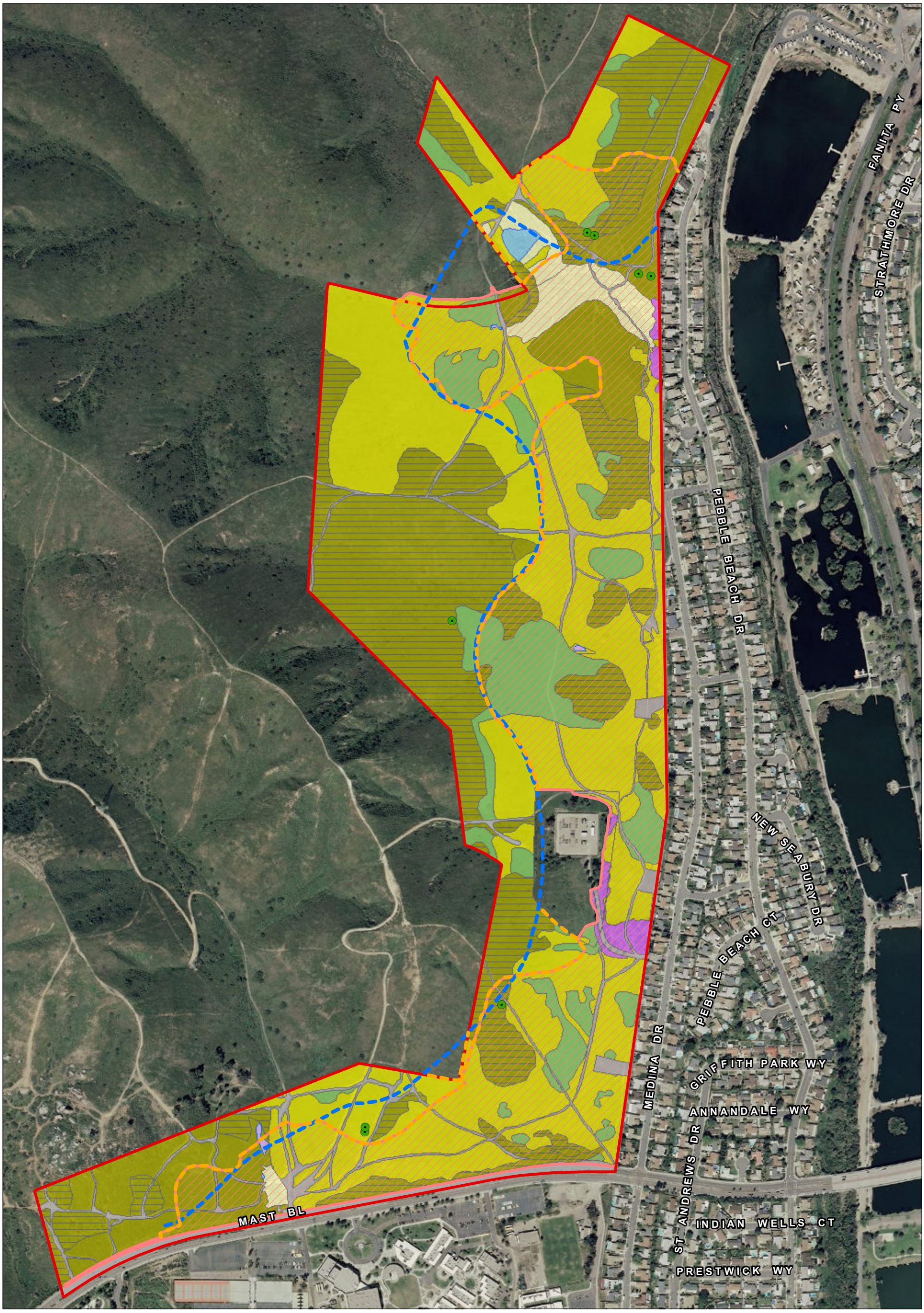

FIGURE 3a

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Annexation Scenario Impact Area

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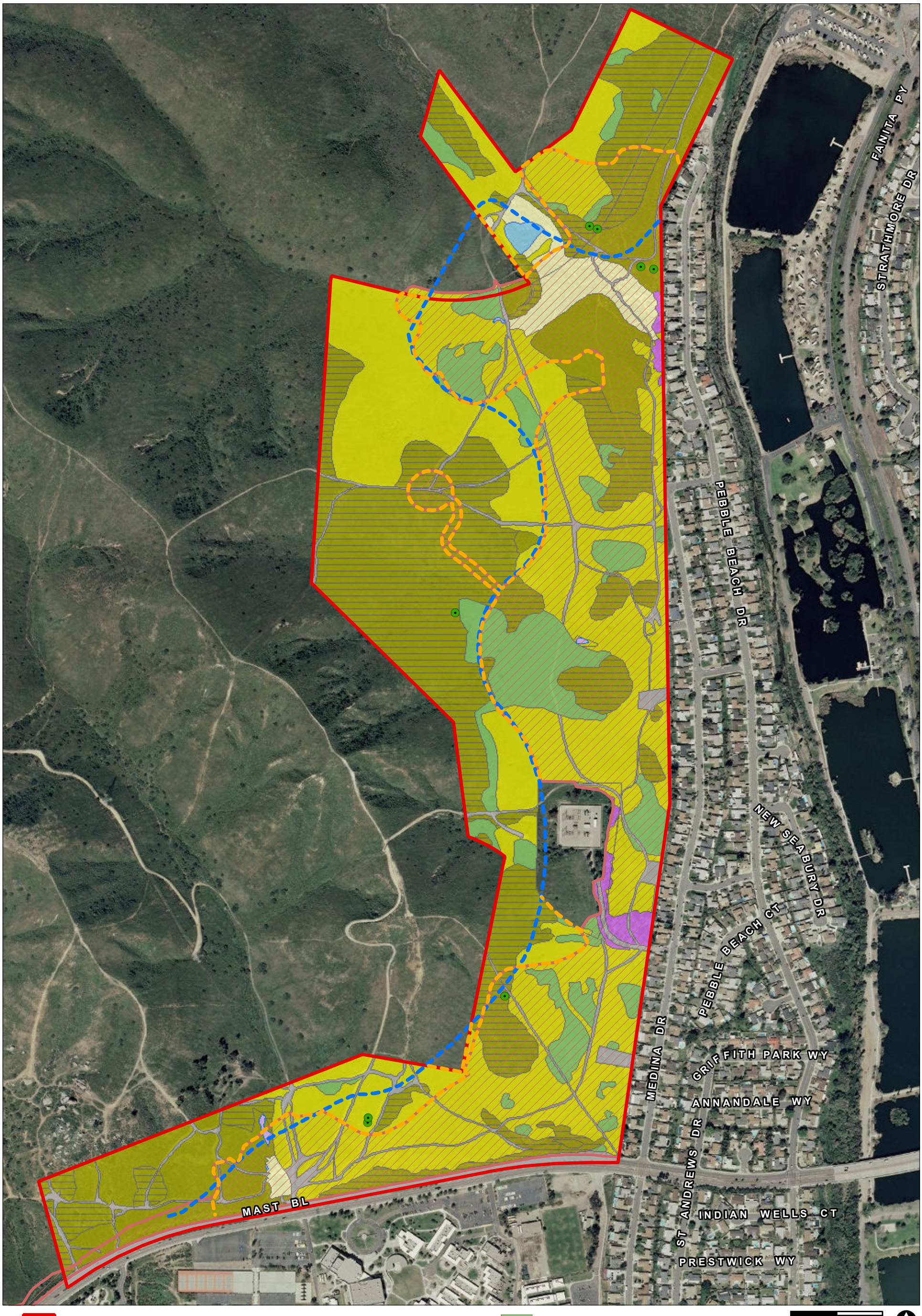

Project Boundary
Proposed MHPA
Existing MHPA
No Annexation Scenario Impact Area
Variegated Dudleya

Vegetation Communities
Coastal Sage Scrub
Disturbed Coastal Sage Scrub
Baccharis-dominated CSS
Annual Grassland
Native Grassland
Coastal and Valley Freshwater Marsh
Emergent Wetland
Eucalyptus Woodland
Disturbed

0 Feet 500

FIGURE 3b

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No Annexation Scenario Impact Area

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The reporting program is designed to document the implementation of this translocation plan and report on results of annual monitoring efforts. The translocation site will be located on suitable soils adjacent to preserved variegated dudleya populations in designated open space within the Multi-Habitat Planning Area (MHPA). The impacts to variegated dudleya for the two project scenarios would be the same, approximately 400 plants (NRC 2012). The translocation area will be large enough to accommodate all of the individuals salvaged from the impact area. For both scenarios, it is anticipated that an approximately 1.0-acre area will be enhanced in and around the translocation area to ensure the long-term sustainability of the salvaged variegated dudleya. Native grassland species will be reintroduced to the translocation site through a combination of hand seeding and use of container plants.

1.1 Existing Conditions

The 203.64-acre Castlerock site is located in the city of San Diego, in the East Elliott Community Planning Area, on the north side of Mast Boulevard between Medina Drive and West Hills Parkway (see Figure 2). It consists primarily of annual grassland on rolling terrain of slopes and ridges, rising in elevation from east to west, and also from south to north on the associated ridges. Coastal sage scrub (CSS) occupies the southwest section of the site, as well as patches in the northeastern and southern sections. Disturbed CSS occupies a significant portion of the site as well, with the majority along the western site boundary. Additional habitats present on-site include baccharis-dominated CSS, native grassland, eucalyptus woodland, coastal and valley freshwater marsh, emergent wetland, and disturbed areas (i.e. graded areas and dirt roads) (NRC 2012). Land uses adjacent to the Castlerock site include the Santee Lakes Regional Park, single-family residences, and MHPA. The maximum elevation on-site is approximately 668 feet above mean sea level (NRC 2012).

Variegated dudleya is a covered species under the City of San Diego's Multiple Species Conservation Plan (MSCP) and it is also listed as a narrow endemic in the MSCP Subarea Plan (City of San Diego 1997a). Seven small patches of variegated dudleya containing approximately 500 plants were observed within the Castlerock site during focused rare plant surveys in 2010 by NRC (see Figures 3a and 3b). Five of the small patches of variegated dudleya (approximately 1,000 square feet) containing approximately 400 plants are proposed to be impacted by the proposed project. Two of the seven dudleya locations (approximately 50 plants each) are in the MHPA. Impacts to variegated dudleya both inside and outside the MHPA are considered significant and mitigation is required (NRC 2012). The salvaged variegated dudleya would be translocated to suitable habitat areas within the MHPA adjacent to the existing population.

1.2 Background on Variegated Dudleya

The conservation status, biology, and distribution of variegated dudleya are described in this section.

1.2.1 Conservation Status

Variegated dudleya is a City of San Diego Multiple Species Conservation Program (MSCP) covered species. It is also listed as a narrow endemic in the MSCP Subarea Plan (City of San Diego 1997a). Outside of the Multiple Habitat Planning Area (MHPA), narrow endemics such as the variegated dudleya are to be protected through the following measures, as deemed appropriate: (1) avoidance; (2) management; and (3) enhancement or translocation to areas identified for preservation. Unavoidable impacts associated with reasonable use or essential public facilities would need to be minimized and mitigated (City of San Diego 1997b).

Variegated dudleya is also on List 1B.2 of the California Native Plant Society (CNPS) Inventory (CNPS 2010). CNPS List 1B.2 plant species are considered rare, threatened, or endangered in California and elsewhere. Furthermore, CNPS considers variegated dudleya fairly endangered in California, indicated by a ranking of 0.2 following the List 1B status.

Variegated dudleya is also on the California Department of Fish and Game's (CDFG) Natural Diversity Data Base Special Vascular Plants, Bryophytes and Lichens List (CDFG 2010), which meets the criteria for state listing under Section 15380 of the California Environmental Quality Act (CEQA) (State of California 1996).

1.2.2 Biology and Distribution

Variegated dudleya is a member of the plant family Crassulaceae (Hickman 1993). The genus dudleya is divided into three subgenera: *Dudleya*, *Stylophyllum,* and *Hasseanthus.* Variegated dudleya is a member of the subgenus *Hasseanthus,* which has specific phenologic characteristics. Members of this subgenus are typically drought-deciduous in summer and survive on starch reserves stored in a subterranean tuberous caudex (stem). Variegated dudleya initiates annual growth after the first significant autumn rains and continues to grow actively through late March or early April. The plants flower from April into early June, with seed setting generally in late June and early July. The seeds of the variegated dudleya are very small, approximately 0.8 millimeter in length, and are generally dispersed by water and wind.

This small succulent perennial typically occurs within the openings of coastal sage scrub, chaparral, and grassland habitats on clay soils and in dry rocky areas. In an average rainfall year, above-ground growth of variegated dudleya is usually visible

approximately six months out of the year. Typically during the initial growing stages (November-February) only the leaves are visible with the central inflorescence beginning to develop in late winter. The flowering period occurs from April to early June.After flowering, aboveground leaves die back, leaving only the dried inflorescence.

Variegated dudleya is restricted to San Diego County and northwestern Baja California, Mexico (Munz 1974), in relatively small disjunct populations from near Black Mountain Ranch in San Diego to near Ensenada in Baja California (Moran 1951; Munz 1974; Bartel 1993; Dodero 1995).

1.2.3 Summary of Previous Variegated Dudleya Translocation Programs

One variegated dudleya translocation effort implemented in the early 1990s has progressed enough to evaluate the persistence of the translocated plants (Dodero 1996). Several hundred variegated dudleya were salvaged prior to grading and construction of State Route 52 between the Sycamore Landfill and Mission Trails Regional Park and translocated into appropriate habitat in Mission Trails Regional Park. Plants were replanted adjacent to existing variegated dudleya populations during 1992 and 1993. Also, ten small experimental populations were started using salvaged plants and by direct seeding. These plants were monitored for three seasons, measuring growth rates, time of flowering, and seed set. Recruitment of new plants from seed produced by the translocated plants was documented during the monitoring period. Newly recruited individuals were also counted each season.

Monitoring data showed that seedlings that germinated on-site took a minimum of three seasons to reach flowering size under natural conditions. The most recent check of the experimental populations in the spring of 2010, by RECON biologist Mark Dodero showed that salvaged plants and recruited seedlings are still persisting after approximately 17 years. Approximately 605 variegated dudleya in 8 locations were relocated in 2010.(For comparison, during the 2010 site check a natural dudleya population located adjacent to the translocated Mission Trails populations had approximately 139 individuals present. It should be noted that no maintenance efforts have been performed on the translocated population since the mid-1990s, and yet the plants have persisted.

Observations of these plants indicates that the greatest threat to the long-term survival of these translocated variegated dudleya populations is weed invasion and the associated herbivory by pocket gophers (*Thomomys* sp.). Non-native species of particular concern are annual grasses such as wild oats (*Avena* spp.) and herbaceous weeds including storksbill (*Erodium* spp.) and smooth cat's ear (*Hypochaeris glabra*) that compete directly with the dudleya for light, water and nutrients.

1.3 Existing Dudleya Populations at Castlerock

Seven small patches of variegated dudleya containing approximately 500 plants were observed within the Castlerock site during focused rare plant surveys in 2010 by NRC (see Figures 3a and 3b). Five of the small patches of variegated dudleya (approximately 1,000 square feet) containing approximately 400 plants are proposed to be impacted by the proposed project. Two of these seven locations (approximately 50 plants each) are in the MHPA. Impacts to variegated dudleya both inside and outside the MHPA are considered significant and mitigation is required (NRC 2012).

The percentage of individuals in a population that flower can vary greatly from one year to the next. In dry years, few individuals flower, while in years with above normal and/or well spaced rains, hundreds of plants may flower in that same population. Based on observation of natural populations, in a near normal rainfall year it is reasonable to expect that approximately 10–20 percent of the total number of individuals in a population may flower, but the timing of rainfall can be equally important in determining how many of the plants flower. In 2007, which was the fourth driest year on record for San Diego, one percent or less of the individuals observed in variegated dudleya populations flowered. All plants present at the impact site will be salvaged and a revised population estimate will be made after the plants begin growth the next season.

1.4 Translocation Goals

Translocation goals for this project include:

- The establishment of a self-sustaining population of variegated dudleya with a minimum survivorship of 80 percent of the 400 translocated individuals (or as many individuals as are salvaged, if the population is larger). Twenty percent of the surviving individuals will be mature flowering plants in any of the five monitoring years at the translocation site.

- The enhancement and restoration of approximately 1.0 acre of native grassland habitat at the translocation site. In addition, a 100-foot protective buffer will be maintained (i.e., weeded) around the translocation site. The control of exotic species, collection of native seed, and propagation and planting of associated native plants will be implemented for the translocation effort.
- A total of 0 percent coverage by Cal-IPC List High, Moderate, and Alert species and no more than 10 percent of the translocation and enhancement area will be covered by exotic weeds at the end of five years.

1.5 Proposed Translocation Site

Selecting a translocation site is one of the most important tasks in planning for plant translocation. Environmental factors such as soil type, slope aspect, sun exposure, moisture regime, weed cover, and plant species composition that can either increase or decrease translocation success. A few reasons why translocations may fail are plant–soil incompatibility, improper slope aspect, weed invasion, and human disturbance. To help ensure translocation success, the following methods of selecting a translocation site were followed. The location and existing conditions of the site selected are also described below.

1.5.1 Selection Methods

The translocation site must have specific environmental conditions similar to the donor site to ensure establishment and persistence of the introduced variegated dudleya population. Four general habitat factors are used to evaluate potential translocation sites: physical, biological, logistical, and historical (Fiedler and Laven 1996).

1. **Physical.** These factors include the soil and landscape characteristics of the site. **Variegated dudleya are typically found in dry rocky clay soils.**

2. **Biological.** These factors include the presence of appropriate habitat and susceptibility to weed invasion. **Variegated dudleya typically grow in openings within native grassland and coastal sage scrub habitat with a low presence of non-native species.**

3. **Logistical.** The accessibility of the site for maintenance and monitoring, and site protection from unauthorized use are logistic factors. **The site shall be easily accessible but protected from off-road-vehicle use or heavy bicycle or foot traffic.**

4. **Historical.** This factor considers using currently occupied versus potential habitat and incorporates knowledge of the species' evolutionary history. **The variegated dudleya shall be translocated near an existing population or in suitable habitat within its historic range.**

1.5.2 Site Location and Conditions

The translocation site is located in the southwest portion of the Castlerock project (Figures 4a and 4b) and will be designated as permanent open space within the MHPA. The site currently supports an adjacent variegated dudleya population; therefore, habitat, soils, and plant associates are suitable. The existing variegated dudleya population was mapped by NRC (NRC 2012).

An area has been chosen as the *specific* translocation site (see Figures 4a and 4b). The existing conditions of the translocation site as they relate to the four environmental factors in the previous section are discussed below.

1. **Physical Conditions.** The site has the appropriate soils and landscape characteristics including dry hillsides and exposed clay soils that contain small cobbles interspersed throughout.

2. **Biological Conditions.** The site has suitable habitat with openings in the native grassland and coastal sage scrub habitat that contains common plant associates of variegated dudleya. The translocation area has non-native weed species that will be controlled as part of the maintenance activities.

3. **Logistical Conditions.** The site is accessible by vehicle and can be protected with fencing. Gates may be installed at strategic locations to control access to protect the translocation area. If deemed to be necessary, a fence and/or a gate will need to be installed prior to beginning restoration activities.

4. **Historical Conditions.** The site is within the species' historic range and adjacent to an existing variegated dudleya population. The site is also within approximately one mile of the donor site.

In summary, the selected area has all of the appropriate characteristics to serve as a translocation site. Variegated dudleya salvaged from the impact area will be planted in disturbed areas of the mitigation parcel adjacent to the existing dudleya population. The proposed project will require the translocation of a minimum of 400 variegated dudleya to the MHPA. Approximately 1.0 acre of non-native grassland will be restored through weed control and seeding with site appropriate to native grassland species. The disturbed areas will be restored to native grassland characteristic of the undisturbed portions of the site. No existing variegated dudleya populations will be impacted by this translocation program. This dudleya translocation area is also serving as a translocation site for coast barrel cactus also salvaged from the Castlerock development footprint. Salvaged coast barrel cactus will also be planted in the vicinity of the variegated dudleya. Combining the dudleya and coast barrel cactus translocation sites will increase the efficiency of weed control efforts which will benefit both species.

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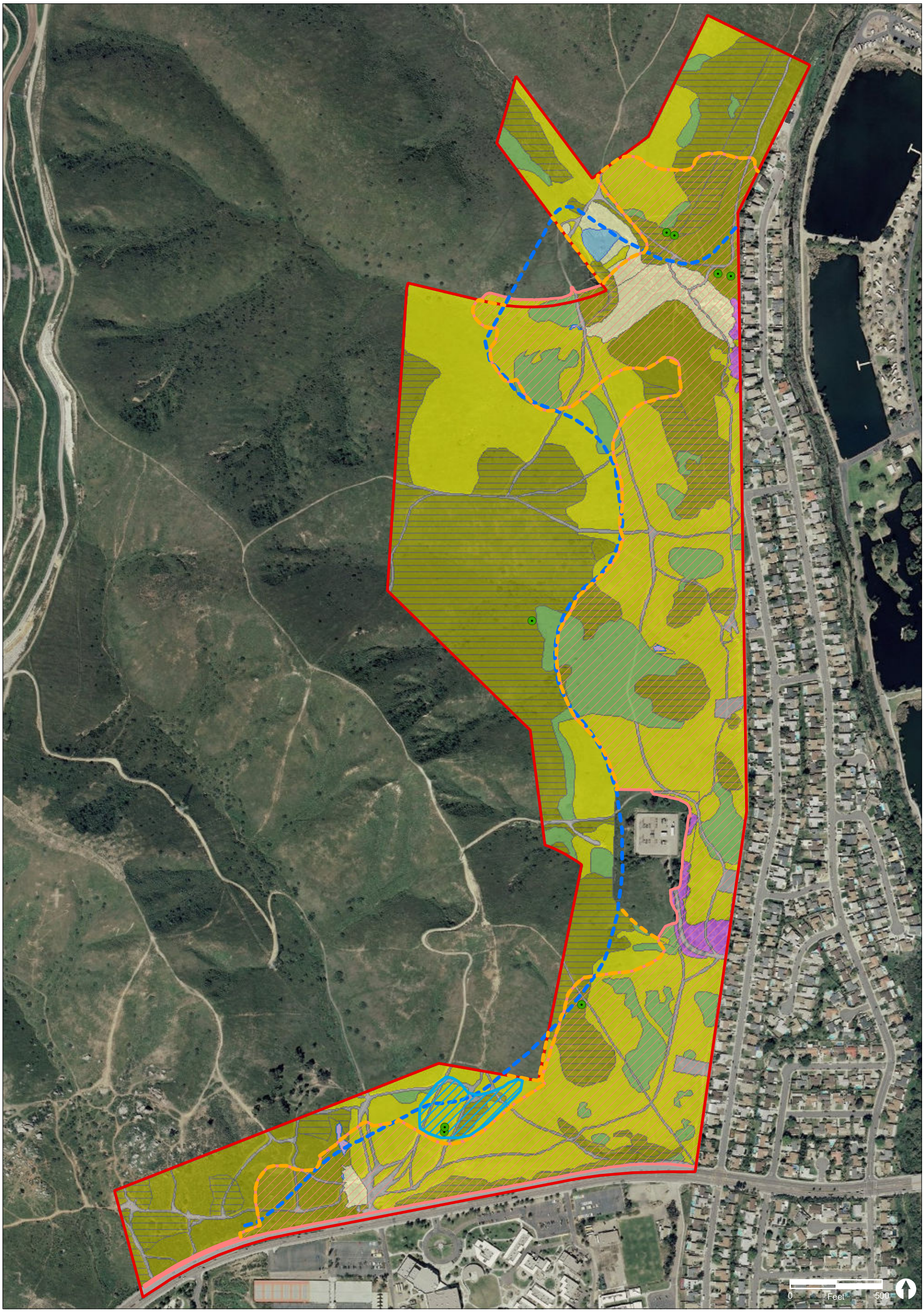

Project Boundary
Proposed MHPA
Existing MHPA
Proposed Project Impacts Area

Vegetation Communities

Coastal Sage Scrub
Disturbed Coastal Sage Scrub
Baccharis-dominated CSS
Annual Grassland
Native Grassland
Coastal and Valley Freshwater Marsh
Emergent Wetland
Eucalyptus Woodland
Disturbed

Variegated Dudleya
Proposed Dudleya Translocation Area

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FIGURE 4a

Annexation Scenario Proposed
Dudleya Translocation Area

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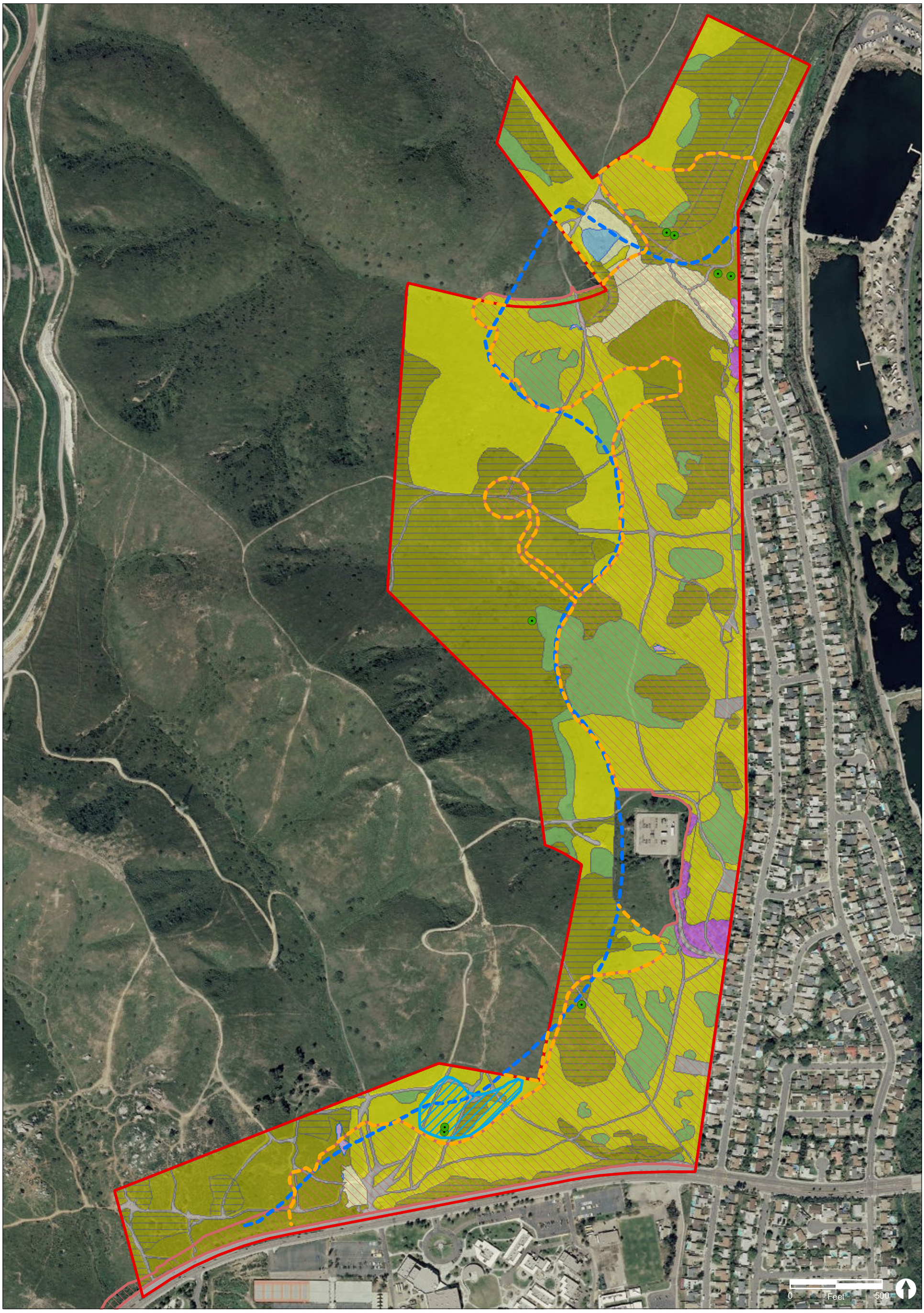

Project Boundary
Proposed MHPA
Existing MHPA
Alternative Project Impacts Area

Vegetation Communities

Coastal Sage Scrub
Disturbed Coastal Sage Scrub
Baccharis-dominated CSS
Annual Grassland
Native Grassland
Coastal and Valley Freshwater Marsh
Emergent Wetland
Eucalyptus Woodland
Disturbed

Variegated Dudleya
Proposed Dudleya Translocation Area

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FIGURE 4b

No Annexation Scenario Proposed
Dudleya Translocation Area

1.6 Responsible Parties

1.6.1 Property Owner

The party financially responsible for this translocation project is:

Pardee Homes
6025 Edgewood Bend Court
San Diego, CA 92130
Contact: Jimmy Ayala, Director, Community Development

The Owner will be responsible for contracting with personnel qualified in implementation, maintenance, and monitoring of restoration/revegetation sites and practices described in this plan. Upon contracting with a qualified person or organization to implement this plan, the Owner will designate a person or group as the Principal Restoration Specialist.

1.6.2 Principal Restoration Specialist

A Principal Restoration Specialist acceptable to the Owner shall be hired to implement this plan. The Principal Restoration Specialist can either be an individual or an organization, as long as the person(s) actively managing the program meets the qualifications outlined below to the satisfaction of the Owner and approved by the City of San Diego Development Services, Environmental Analysis Section and Mitigation Monitoring Coordinator. If the Principal Restoration Specialist is an organization, a project manager shall be designated. The Principal Restoration Specialist will be responsible for the day-to-day implementation of this plan and will carry out the requirements and objectives described herein. The Principal Restoration Specialist will also attend any pre-construction meetings pertaining to the translocation site.

1.6.2.1 Qualifications of the Principal Restoration Specialist

The individual or project manager identified by the organization contracted to implement this Plan must meet the following criteria:

- B.S. or B.A. degree in ecology, botany, biology, or related field.
- At least three years of experience in restoration of native habitats in southern California, preferably San Diego County.
- Demonstrated experience in variegated dudleya translocation and restoration projects.

2.0 Methods

2.1 Variegated Dudleya Translocation Methods

Translocation will include seed collection, plant salvage, and plant propagation. Table 1 summarizes the proposed translocation schedule. Translocation efforts during the first season will be focused on weeding the translocation site to prepare the area to receive the salvaged dudleya. Depending on the project permitting and grading schedule the maintenance and monitoring period may begin in the winter of 2013–14 (Year 1) when the dudleya are replanted at the translocation site.

TABLE 1
VARIEGATED DUDLEYA TRANSLOCATION SCHEDULE

Task	Implementation Tasks	Year 1 2013	Year 2 2014	Year 3 2015
Seed collection	Spring/Summer 2012	Spring/Summer	—	—
Plant propagation from seed	Fall 2012	Fall	Fall	Fall, if necessary
Plant salvage	2012-13 Fall/Winter	—	—	—
Planting		Fall/Winter 2013-2014	Winter Seed Grown Plants	Fall/Winter, if necessary

NOTE: The translocation schedule is subject to change based on the timing of project grading. The schedule outlined above is approximate.

2.1.1 Seed Collection

If available, seed collection will begin in the spring of 2012 and will occur again during the spring of 2013 or beyond, as needed. To maintain the genetic integrity of any nursery-grown plants all seeds will be collected on-site from existing populations within the open space lots, or from existing populations within three miles of the project site. Whole dried inflorescences will be collected soon after the flowering period (April–May) when seeds are fully mature.

The seed will be placed in paper envelopes, which allows for the evaporation of residual moisture to prevent fungal growth. Seeds will be stored in a cool, dark location to prevent desiccation and maintain viability. A portion of the seeds will be used to propagate additional plants for planting at the translocation site. The rest of the seed will be stored for future direct seeding into the restored habitat.

2.1.2 Propagation

To ensure that success criteria are met, additional variegated dudleya will be produced from locally collected seed. Propagation of variegated dudleya from seed under nursery conditions is an effective method of producing large number of plants. Studies of rare plant species have shown that growing plants to beyond seedling size, prior to transplanting, increases survivorship after planting (Guerrant 1996). Propagated plants will be grown from wild collected seed to maintain genetic integrity of the population.

Seed will be sown in greenhouse flats in the fall of 2012 (if seed is available) and again in 2013 if more plants are needed. Plants will be grown at the RECON Native Plants, Inc. nursery for a minimum of one season, and then will be transplanted into the translocation site.

2.1.3 Plant Salvage

In addition to the propagation of variegated dudleya from seed, the plants from the donor site will be salvaged during the 2012–2013 fall-winter season soon after the rainy season starts, but also dependent on the project grading schedule. Variegated dudleya shall be salvaged from impact areas. Variegated dudleya can only be salvaged effectively during the winter growing season when all the plants are visible. Variegated dudleya will be excavated from the site using hand tools. If the project grading schedule permits, other grassland species such as purple needlegrass and geophyte species may also be salvaged and planted at the translocation site.

2.1.4 Translocation

Prior to salvaging the donor population, the existing population of variegated dudleya at the translocation site will be mapped in detail, during the winter-spring of 2012–13, to delineate the boundaries and distribution of the population. This mapping will be done to ensure that the existing population of dudleya will not be impacted by the translocation efforts. The mapped locations will also be flagged for identification during non-flowering times of year. The salvaged dudleya will be planted during the winter of 2013–14, if weather patterns are favorable. Additional plants propagated from seed may be planted during the 2014–2015 winter season to ensure that success criteria for survivorship and flowering are met.

The project biologist will determine the exact timing of translocation based on weather conditions. In general, the variegated dudleya will be salvaged and planted during the middle of the rainy season (December–March) when the soil is moist from recent rains and rain is predicted within a few days. See Table 1 for the proposed translocation schedule.

Protecting the plants from herbivory is critical to the success of this translocation project. The following procedures will be used when planting the salvaged and propagated dudleya. To minimize herbivory, hardware cloth will be placed in the bottom of the excavated area prior to setting the plants into the soil. After the lower hardware cloth is in place, a small amount of soil will be put on top. Then each flat of dudleya will be set into on the soil, flush with or slightly below the existing soil surface to prevent erosion of the caudex from the soil. The newly installed plants can tolerate some deposit of soil, but not exposure of the caudex from soil eroding away from the base of the plant. After the plants are in place another layer of hardware cloth will be put over the plants and the lower and upper layers of protective cloth will be tied together. This system will provide protection from gophers, squirrels and rabbits that often eat the newly planted dudleya. The cages will still allow for the developing inflorescences and pollinating insects to pass through the screen.

2.1.5 Irrigation

The translocation of the variegated dudleya will be timed to coincide with natural rainfall events. If necessary, a water truck will be used to irrigate newly planted caudices until they become established or during extended dry periods during the winter growing season. Watering will be discontinued as the plants go into summer dormancy.

2.2 Habitat Enhancement Methods

Enhancing the habitat by weeding the translocation area is necessary to ensure survival and persistence of the introduced variegated dudleya population. A total of approximately 1.0 acre of habitat will be enhanced for the salvaged dudleya. The enhancement area will be within the proposed translocation site boundaries shown in Figures 4a and 4 b. Enhancement will consist of a weed control program, seeding and planting of container stock, if necessary. Species to be used for seeding and planting may include purple and foothill needlegrass, bulbs, and annual flowering species. Non-native weeds to be controlled include, but are not limited to annual grasses such as wild oats (*Avena* spp.) and forb species such as stork's bill (*Erodium* spp.).

The translocation area must first be dethatched. Dethatching is a technique that is used to remove the build-up of non-native grasses and other non-native herbs so that exotic species are controlled and openings within the habitat can be maintained. Dethatching will be conducted in late summer or early fall after native species, including the variegated dudleya, have become dormant for the season. The schedule for the dethatching effort is timed to minimize impacts to native vegetation. All work will be performed by workers trained to recognize native and non-native species. Weed whips will be used to cut the dried weedy material left from the previous seasons' growth.

After the thatch is cut, the material will be raked into piles, collected, and transported to the nearby landfill or composed on-site. The dethatching will be performed once at the start of the project. It is anticipated that dethatching will take place in the fall of 2012 or 2013 dispensing on the project grading schedule. After winter rains commence, weed seed still present in the soil will germinate. Control of non-native seedlings during the growing season will include hand pulling around native species, including the variegated dudleya. No existing native vegetation will be disturbed and no fertilizers will be used in the translocation area. Herbicide spraying, using glyphosate based herbicide or grass specific herbicide (fusilade), will also be used in areas where non-native species dominate. Approximately four weeding visits per season will be made during the first and second year after the translocation of salvaged dudleya. Glyphosate-based herbicides and grass-specific herbicide (fusilade) are approved for use in natural areas by the U.S. Fish and Wildlife Service (USFWS) and CDFG, and must be applied by a licensed applicator.

3.0 Translocation Site Management

Management includes weeding around the variegated dudleya population and maintaining the approximately 1.0-acre enhancement and restoration area. An adaptive management approach is necessary to ensure the survival of the translocated population of variegated dudleya (Pavlik 1996). Adaptive management refers to the ability to slightly field modify translocation, monitoring, and maintenance techniques to reflect a better understanding of the species or to adapt to any atypical events that may occur during the five-year program. The proposed monitoring, maintenance, and reporting programs are described below.

3.1 Maintenance

Maintenance tasks include watering during the first planting season, exotic species control, and replacement planting, if needed. A comprehensive weeding program is especially important, as variegated dudleya populations are sensitive to invasion by exotic species. Only hand weeding will be allowed within 36 inches of translocated or existing variegated dudleya patches. Variegated dudleya translocation plots will be temporarily covered with a non-porous material, such as a tarp, during spraying to further reduce the risk of herbicide overspray. Table 2 outlines the proposed maintenance schedule.

3.1.1 Irrigation

The newly translocated variegated dudleya may require supplemental watering during the first season of growth at the translocation site. If, during the rainy season between

November–April, there are more than two to three weeks of dry or unusually warm weather and the new plants appear water stressed, the variegated dudleya will be watered using a water truck. Enough water will be given to saturate the top four to six inches of soil. Watering of the translocation site will mimic natural precipitation patterns, and, therefore, will not exceed the typical rainfall season (November–April). A water truck and hose will be used to irrigate the translocation site. Seed propagated caudices that are planted in the third season may also be watered, if needed.

TABLE 2
FIVE-YEAR MAINTENANCE SCHEDULE

Type/Task	Year 1 2013–14	Year 2 2014–15	Year 3 2015–16	Year 4 2016–17	Year 5 2017–18
Hand watering	As needed	As needed	As needed	--	--
Weed control	Quarterly	Quarterly	Quarterly	Three times	Twice
Repair Fencing/ Gates (if necessary)	--	As needed	As needed	As needed	As needed
Planting	Winter	Winter	Winter, if needed	--	--

3.1.2 Weeding

Weeds must be removed by well-trained and skilled maintenance workers under close supervision of the project biologist to prevent impacts to the variegated dudleya and other biological resources at the translocation site. Only hand weeding will be allowed within 36 inches of translocated or existing variegated dudleya patches. Outside of this area, weeds may be removed by mechanical weed cutters or sprayed with herbicide. Variegated dudleya translocation plots will be temporarily covered with a tarp or similar item during herbicide spraying to further reduce the risk of overspray. When herbicide is used, there shall be little to no wind present, as overspray may potentially harm native plants.

Weeds should be removed at least four times annually for the first three years to adequately control weed species and reduce the weed seed bank in the soil. In years 4 and 5, approximately three weeding visits per season will likely be necessary.

3.1.3 Site Protection

Protection of the translocation site from human disturbance is essential for success. Of particular importance is protection of the translocation sites from pedestrians and off-road vehicles. Currently, the proposed translocation site is unfenced and the site is accessible by vehicles. There is a graded dirt road adjacent to the site provides access to the translocation site. This access is helpful for implementation of the translocation

program, but the road may also allow unauthorized vehicles to enter the area. We recommend that gate and/or fencing at strategic locations to prevent unauthorized vehicle access (see Figures 4a and 4b). Any gates and/or fencing will be installed in consultation with City and project owner. Signs identifying the area as a restoration site may also be necessary.

3.2 Monitoring

Monitoring of the translocation site requires frequent site visits and collection of qualitative and quantitative data to ensure the project is progressing toward the stated goals. The performance standards and monitoring methods are described below.

3.2.1 Performance Standards

The final performance standards of the variegated dudleya translocation plan are:

- The establishment of a self-sustaining population of variegated dudleya with a minimum survivorship of 80 percent of the 400 translocated individuals. Twenty percent of the surviving individuals will be mature flowering plants in any of the five monitoring years at the translocation site (without supplemental water).

- A total of 0 percent coverage by Cal-IPC List High, Moderate, and Alert species and no more than 10 percent of the translocation and enhancement area will be covered by exotic weeds at the end of five years.

- The translocated individuals shall have survived without supplemental watering for at least two years.

If in any year significant progress towards the performance standards is not observed, then the project biologist or the City of San Diego may recommend remedial actions. In addition, if final performance criteria are not met within the five years, remedial measures and additional years of monitoring and maintenance may be required by the City of San Diego. Appropriate remedial actions are discussed below.

3.2.2 Monitoring Methods

A monitoring program will be conducted for five years following the initial planting. Monitoring is necessary to determine the survival and performance of the transplant population and to adjust procedures as needed to ensure progress toward restoration goals. Monitoring will be conducted by a biologist with experience in the preparation, implementation, and monitoring of dudleya translocation programs.

The monitoring program will include both quantitative and qualitative assessments of the translocated population. Table 3 summarizes the monitoring schedule. Quantitative data will be collected by annually estimating all surviving and flowering individuals. Qualitative data will be collected by visually comparing the stages of development within the translocated population to the natural population nearby. Pollinator observations at the translocation site and the adjacent preserved variegated dudleya population (reference site) will also be conducted to make a general comparison of the pollinators of the two areas. Monitoring methods are described in detail below.

TABLE 3
FIVE-YEAR MONITORING SCHEDULE

Type/Task	Year 1 2013–14	Year 2 2014-15	Year 3 2015-16	Year 4 2016-17	Year 5 2017-18
Qualitative Monitoring	Weekly/ Monthly*	Quarterly during growth	Quarterly during growth	Quarterly during growth	Quarterly during growth
Quantitative Monitoring					
Survivorship Counts	--	Winter	Winter	Winter	Winter
Flowering Counts	Spring	Spring	Spring	Spring	Spring
Exotic Cover estimate	Spring	Spring	Spring	Spring	Spring

*Qualitative monitoring will occur weekly during the 120-day PEP.

3.2.2.1 Quantitative

a. Survivorship Estimates

Each translocated variegated dudleya patch at the translocation site will be numbered by the monitoring biologist. Permanent markers will be placed near each patch so they can be found easily each year. The translocated patches will be mapped using a global positioning system (GPS) so the areas can be relocated if markers are lost. The number of individuals within each patch will be estimated when they are planted. This data will be used as a baseline so survivorship in subsequent years may be assessed.

A dudleya population census will be conducted at the translocation site each year. The first annual census shall be conducted in the second growing season so that the formation of aboveground leaves may be observed. This assessment will be used to determine the total number of translocated individuals that have survived over the summer dry season. Each monitoring year, the individuals within each patch will be estimated and recorded. Percent survivorship will be calculated by dividing the number of surviving plants by the baseline number of plants. Because individuals are densely packed within each clump and the plants are small in size, these counts will be approximated (±5 percent). In addition, the areas immediately around the translocated clumps will be searched carefully for volunteer variegated dudleya plants. All volunteer plants will also be counted.

b. Flowering Estimates

The second quantitative assessment will be conducted later in the growing season (April–May) when the production of flowers and seed may be observed. Total estimates of flowering individuals will be completed at that time. The project biologist will record all observations and include the results in the annual report.

c. Exotic Species Cover

Exotic species cover will be estimated annually to determine if the cover criteria for weeds are being met. Weed cover will be estimated at the translocation site as a percent of the total plant cover. Permanent photo points will be established at selected locations within the translocation and enhancement area. Repeat photographs will be taken each spring and these photographs will be included in the annual reports.

3.2.2.2 Qualitative Monitoring

Two types of qualitative assessments—general growth assessments and also limited pollinator observations—will be conducted during the translocation effort. Evaluation of plant health and identifying and correcting problems as they arise are necessary for ensuring successful vegetation establishment. Following planting, the site will be monitored weekly during the initial 120-plant establishment period (PEP). After the PEP, qualitative monitoring will be conducted monthly during the growing season for the remainder of the first year and quarterly for the remainder of the five-year maintenance and monitoring period.

a. Growth Assessment

The performance of variegated dudleya individuals at the translocation site will be visually assessed to determine the overall plant condition and whether the timing of leaf, flower, and seed production is similar to the adjacent natural dudleya population. It is expected that during the first season after planting, the translocated population may behave differently than the natural population because plants were cultivated under greenhouse conditions and have not yet adapted to natural environmental conditions. Plant behavior refers to the timing of certain life history events such as leaf and flower production. After the second year, the translocated population is expected to show a similar life history pattern as the natural population. The adjacent natural dudleya population will be used as a reference.

b. Pollinator Observations

Pollinator observations will be conducted to determine if potential variegated dudleya pollinators are visiting the translocation site. This will help evaluate the progress of the variegated dudleya translocation and habitat enhancement effort. If the habitat

surrounding the translocation area is enhanced appropriately it will likely be able to support a sufficiently diverse assemblage of pollinators that will ensure successful pollination and seed production of variegated dudleya (Buchman and Nabhan 1996). The production of viable variegated dudleya seed is important for reproduction and therefore the long-term persistence of the translocated population. Observations of pollinators will also help contribute to the overall understanding of the biology and reproduction of this species.

Pollinator observations will be conducted once each season during the variegated dudleya flowering period (approximately April–May). Observations shall be done in conjunction with other scheduled monitoring visits. The project biologist will stand near the variegated dudleya plants and observe and photograph pollinators for approximately one hour during the visit. Both the translocation and the adjacent natural population will be observed. Pollinators that are observed will be identified to family if possible. The type of pollinators observed visiting variegated dudleya at the translocation site will be used for a general comparison with that of the natural population.

3.3 Reporting

An as-built report will be submitted to the City of San Diego documenting the translocation of the variegated dudleya.

Two copies of the as-built report shall be submitted to the City of San Diego at the end of the 120-day PEP. This report shall include a discussion on weed control, horticulture treatments, erosion control, trash/debris removal, irrigation, site protection/signage, pest management, and vandalism as applicable to this translocation project. A visual assessment shall be provided at the end of the 120-day PEP to determine survivorship of the variegated dudleya translocation effort.

Three copies of the annual monitoring reports summarizing monitoring results of the variegated dudleya translocation effort will be submitted to the City of San Diego and the wildlife agencies by the project biologist no later than December 15th each year. The monitoring section will include survey methods, data summary analysis, comparison of performance standards, discussion, reporting remedial actions, recommendations, and photodocumentation. The maintenance section will include weeding procedures and plant care activities. Each annual report from year 2 on will compare findings of the current year with those in previous years.

3.4 Remedial Measures

The project biologist or the City of San Diego may recommend remedial measures based on the annual quantitative monitoring results or qualitative observations made in

the field so that the plantings move toward the performance standards. If the variegated dudleya requirement of 80 percent survivorship and 20 percent flowering is not met, additional planting of propagated variegated dudleya from seed may be required. Propagation, planting, monitoring, and maintenance would follow the methods discussed in this plan. Other remedial measures may also include more intensive weeding efforts within the translocation area which may add additional monitoring years.

3.5 Contingency Measures

The contingency measures for the potential loss of variegated dudleya individuals due to herbivory, drought, vandalism, and fire are as follows.

a. Herbivory/Disease

If more than 20 percent of the translocated variegated dudleya plants have evidence of herbivory (i.e., chewing of leaves and digging up of caudices), additional wire mesh or natural brush may be placed around the variegated dudleya clumps at the discretion of the project biologist. These methods will be used to discourage herbivores. If herbivory is still observed after installation of the protection cages or brush, the damaged/missing plants will be replaced. The replacement plants will be planted in a different location within the translocation area to try and minimize herbivory. Any diseased or pest-infected plants of variegated dudleya will be removed as needed and replaced with healthy plants.

b. Vandalism

If bicycle or foot trails are observed within the translocation area, natural methods will be used to discourage trail use. Natural methods include piling of brush material at the entrance of the new trail and planting of shore cactus (*Opuntia littoralis*). If the trails are still active, then additional fencing of the translocation area along the dirt road may be required.

c. Drought

During the first two seasons after translocation, if the variegated dudleya begin annual growth (leaf structures are observed above ground) and a long period of dry weather follows, the translocated population *will be* watered on a weekly basis until it rains or the plants have set seed. However, the plants *will not be* watered to induce aboveground growth, as it is natural for variegated dudleya to remain dormant during times of extreme drought. By the third season after translocation no supplemental water will be given to allow the plants to respond to the natural rainfall pattern, unless additional new dudleya are planted in year 3. Any newly planted dudleya would likely need supplemental water.

d. Fire

Because variegated dudleyas are dormant during the typical fire season (May-November), it is highly unlikely the plants will be damaged by fire. The proposed weeding program for the dudleya translocation will further reduce the probability of fire damage to the plants. If plants are damaged by a fire, the plants will be replaced with no additional monitoring or maintenance time added to the original five-year requirement.

4.0 Notification of Completion

After the fifth year success criteria are met, the final monitoring report will be submitted to the City for review. If the project has met the performance standards outlined herein, the project biologist will contact the City of San Diego and recommend final approval of the project. A request for a final inspection shall be submitted with the final monitoring report. The City will respond in writing after a review period or may request an on-site meeting to review the translocation area. After review, the variegated dudleya mitigation requirement will be deemed complete when written approval by the City of San Diego has been received by the project owner. Upon confirmation of project success, the City shall release the project owner of all obligations. The applicant understands that failure of any significant portion of the revegetation area may result in a requirement to replace or renegotiate that portion of the site and/or extend monitoring and establishment/maintenance period until all success criteria are met.

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